

SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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VIENNA EXHIBITION—No. IV. RUSSIAN MINERALS.

the largest European consumers of British manufactured many years past has been Russia. And though lately most efforts have been made to develop her mineral resources, these resources have given rise to most active mechanical metallurgical industries, yet these are all too feeble to meet the increasing requirements of this progressive nation.

In the *exposé* of minerals and metal work in the Russian cannot be called extensive, yet representing, as it does, every centre of industry, it forms an admirable miniature of metallurgical developments. With the help of the specimens and sections of many of the districts, we purpose to show the present condition of Russian metallurgy, as evinced at the Exhibition.

At the north, on the east of the Gulf of Bothnia, where geological maps the rocks are marked "granitic," we find iron ore, obtained chiefly from the lakes and marshy flat district. It seems very similar to the ores used for purposes in the North of England, known as Irish bog iron, samples of which are displayed, made entirely from does not appear equal to good South Staffordshire brands. These have been worked above half a century. A limited company, Tushby, produces fair specimens of bar-iron, but their operation are somewhat primitive. Water-wheels are used for power, and with a force of less than 50 workmen iron of value of 350,000 marcs is produced. Similar ores are from the neighbourhood of Uliabourg and Hamlekarleby, considerable quantity of nails is manufactured. The iron in beds, and in no way resembles the deposits of hematite in this district, but is more akin to the Antrim ores.

On Lake Ladoga and the Gulf of Finland is another iron. The largest work is that of Warschavsky and Co., at Raivola. The ores are mined chiefly in the neighbourhood of and by mixing the ores from various parts of the district. The ores are white and mottled grey pigs are produced. These are also exhibited from this firm of plates and strip, and of angle-iron: some of these latter were bent cold, displaying a good quality of iron. This work employs 1000 hands, motive-power of 500-horse, supplied by six water-wheels, the machinery. There is one blast-furnace, which smelts 11,000 tons of ore from their own mines. The pig-iron is in ordinary reverberatory furnaces, of which they have 16. The annual output of crude and finished iron is 200,000.

Nicolas Poutiloff, of St. Petersburg, there are exhibited an collection of the chief minerals of Finland, and also of the minerals and productions of his works near the and in the department of St. Michael. In this immense ment are comprised the mining and raising of the iron ore: in the blast-furnaces, of which there are four, producing to the specimens here shown, mottled and grey pigs quality; about 80 puddling-furnaces, keeping in activity ous steam-hammers, and 11 plate and sheet mills, &c. The process for steel manufacture is also in operation. Two ers are employed, making steel ingots. These are subse- reheated, and rolled into rails. No less than 14 steam- are in operation, and 150 tool-machines. The motive- for these extensive works was formerly water; at present are 7 water-wheels working, and over 30 steam-engines of sizes, having an aggregate horse-power of 1200. The hands in the ironworks alone number 4000, and the total num- ber of miners, carriers, and others employed by the firm, is 18,000. The rails are made with steel heads, partly on the principle as we described in the Journal in our account of the Saxon Forge at Marienhütte (vide "Mineral and Works of No. IX."), but without the peculiar T-form of the steel bar in the annealing pack, and destined to form the head of the rail, which is adopted with such good results at that work. The field of rails, steel headed, is 35,000 tons, whilst of other iron work, the greater part of which is connected with work and rolling stock, the output amounts to the annual 160,000.

St. Petersburg, also, are several ironworks for the manufacture of arms and military projectiles; some belonging to the State, others owned by private persons, but more or less occupied in Government orders. From the Royal Arsenal of St. Petersburg are exhibited various specimens of bronze cannons and shot, which cut but a poor figure compared with the splendid work of German manufacture. The iron carriages for these cannons are from Bird's establishment, which has sent separately no examples to the Exhibition; but the ironwork of this make has a reputation second to none in Russia. The cannon foundry of St. Petersburg shows a few good examples of steel guns and mortars, larger than 10 inches. There are 1200 workmen employed in the cannon works, and the annual value of 160,000.

The most important mineral district of Russia is along the Ural Mountains, and along the upper courses of the Volga and its tributaries. This district, known as the Government Perm, has been worked with great success for more than a century, and has produced and rendered marketable in that period quantities of gold, platinum, copper, iron, and graphite. The large establishments in this district are Government works, for the production of their produce to the army, navy, and civil consumption. Good specimens of merchant bar-iron and plates are from the Kamsk forges, situated on the Viatka river. The produce of these works is armour plates for forts and vessels, which it sends out about 3000 tons annually; but we do not concern ourselves with the quality or finish, to plates of other materials, of which we shall have to speak in describing German iron. In this same district the Government has also the celebrated Kamsk works, where anchor chains, gun barrels, locomotives, steamboats, rails, &c., are made, forming one of the important of the Russian Government metallurgical establishments. The output in plates and material for the navy alone exceeds 10,000 tons. The display in the Exhibition is, however, very small, and by no means commensurate with the importance of the district.

At the south, in the extensive works of Demidoff,

The productions exhibited include several varieties of iron ore, which in this district occurs in pretty regular beds, to the number of 46 workable seams. One of the thick beds at Vyssoka-Gova is an extremely pure magnetic ore, equal to the best Swedish specimens, and estimated to be capable of yielding 50,000 tons yearly for centuries. Many of these ironstone measures occur in the clay, in bands from 2 or 3 in. to over 1 ft. thick. In places the ironstone is found in balls, not unlike the famous "balls" of the Black Country measures. In fact the whole of the extended plateau about the sources of the Oka, Kama, and Don seems to be largely impregnated with ferruginous deposits. The examples of pig-iron here exhibited seem of a very good quality, due, doubtless in some measure, to the admixture of the various kinds of ore. In these extensive works there are 14 blast-furnaces, and sheet and rolling mills, Bessemer steel and rails, and steam-hammers, that eclipse in extent the famous Barrow Works, in England, or Sir John Cockerill's, at Liège. The total ironstone raised from these pits last year amounted to 75,000 tons, whilst from the forges the yield of bar and rolled iron was 6000 tons, and of plates and sheets nearly 8000 tons, and of various kinds of manufactured steel about 500 tons. The same establishment also carries on the mining and metallurgy of other metals, chiefly copper, gold, and platinum. The cupreous ores here exhibited are of great richness, and some of the specimens of malachite were especially beautiful. In some instances the copper was associated in the matrix with iron and gold. The greater part of these ores is extracted from the mines of Médo-Roudiansk, which are extensive and rich enough to keep the works fully employed, and have continued to do so for the last 60 years. During that period about 2,500,000 tons of copper ore has been raised, and 600 tons of malachite, of great beauty. From the smelting works where these ores are smelted and reduced into ingots there have been produced since their erection, about the beginning of this century, nearly 85,000 tons of refined copper. The blocks and ingots displayed show a good quality of metal, and it is said to possess great ductility, though no means were afforded of judging of that property, except by the fracture of the ingots, which is but a far-fetched criterion. Last year the mines raised 46,000 tons of mineral, which at the works yielded 1530 tons of refined metal. Besides the iron and copper industries this immense concern also carries on, with great success, the mining and washing of gold and platinum. The auriferous gangue occurs in various lodes or beds, which are said to number 107, while of platina-bearing measures there are 20. Since 1823 there have been 20 tons of gold extracted, and over three times that quantity of platinum. Indeed, the chief supply of the latter metal is drawn from this district. It occurs in the measures apparently formed from the debris of the Urals; and though it has never been found, like gold, embedded in its parent rock, it is supposed to have been originally associated with serpentine. The produce last year was 35 cwt. of crude platina, and 54 cwt. of gold dust. The most famous of the gold mines in this district is the Berezhovsk, which has been wrought with vigour for the last 130 years. This is, we believe, the only place where the mining of gold is carried on in Russia by means of vertical shafts and levels driven out along the lodes in the quartz; the general plan being to get out the auriferous matrix by open work in the alluvial debris, and to proceed to no great depth. The average value of vein stuff actually crushed and washed here for a number of years is 0.0011 per cent., which is equal to 60 dwts. to the ton of quartz. The description of the methods here followed to wash and amalgamate the gold we shall more fully enter into when we come to speak of the mines of Ekaterinbourg, which were the cradle of gold metallurgy in the Urals, and still are the official centre, and which exhibit models of the various washing and dressing apparatus there used. Some of these metalliferous mines have been worked now for more than a century, the estate, or concession, having been gradually enlarged from time to time, till at the present moment this vast property extends on both sides of the Ural chain, and comprises a total area of nearly 340 square miles, the greater part of which is clothed with rich forests. The total number of hands employed in these mines and works, and in the accessory industries, is 54,000, including a considerable number of women.

Another display of specimens of the metallurgy of copper is sent from the Paschkoff works, in the same district of Verkhotourie. Here the various stages of the copper process are exhibited, from the raw ore, through the various dressing and smelting operations, to the matts and finished ingots. This firm manufactures an excellent quality of metal, and exhibits very good specimens of sheets and wire. The latter especially bears most favourable comparison with other brands for its ductility. This copper foundry, which has been in operation more or less for a century, has 12 reduction furnaces, and yields annually 220 tons of refined and manufactured copper. The staff of workmen numbers 1200. Water-wheels are used as the motive-power.

In our next article we purpose to review the position of the metal industries in Central and Southern Russia, and especially the newly developed, and some undeveloped, coal fields in the South, where there are most favourable openings for the remunerative employment of British capital.

PATENTS.—In the year 1872 there were 3970 petitions presented for grants of letters patent in this country, and a stamp duty of 5*l*. was paid upon each; there were 2988 notices given of intention to proceed with the application, and these also bore a stamp of 5*l*. each; there were 2773 warrants signed for patents, also with the 5*l*. stamp; 2771 patents were actually sealed, and also bore the 5*l*. stamp. In the same year 2745 specifications were filed, bearing the 5*l*. stamp. The progressive stamp duty of 50*l*. was paid upon 791 patents to prevent their becoming void at the end of their third year; and the further duty of 100*l*. was paid on 193 patents to prevent their becoming void at the end of their seventh year, when half their term had run out. About 72 per cent. are allowed by non-payment to lapse at the end of the third year, and only about 9 per cent. are kept alive beyond the seventh year. The fees on patents paid in 1872 to the Attorney-General and his clerk amounted to 6030*l*.; the Solicitor-General comes under the new rule for payment of the law officers by salary for non-contentious business. The compensations payable from the patent-fee fund to the Scotch and Irish law officers amounted in the year to 3450*l*. The whole income reached 137,840*l*. and the expenditure left a surplus of 85,611*l*.

THE IRON AND STEEL INSTITUTE OF GREAT BRITAIN.—No. II.

THE EXCURSIONS.

We have already announced that all the works in the neighbourhood of Liège were to be thrown open for the inspection of members of the Institute. This was not only done ungrudgingly, but wherever visitors with their members' cards, which were the universal "open sesame," put in an appearance they were cordially received and bountifully entertained. Unfortunately, the multitude of *fêtes*, dinners, and receptions arranged by the local committee prevented the Institute from fulfilling to the due extent its legitimate mission; and were it not that the heartiness and munificence of the reception is regarded on all hands as a manifestation of national feeling towards England, and has even been so expressed by the President himself, there would be good ground for regret that feasting and *fêtes* were made paramount to the useful work in which the Institute is engaged. As it was, the excursions, with one exception, were somewhat of a failure—a failure, we mean, in the sense of lack of time, preventing their accomplishment to anything like the full extent. The exception we have made is in favour of the visit to the world-famed works of the Société John Cockerill and Co., at Seraing. An excursion of all the members of the Institute was arranged for the visitation of this establishment on Wednesday afternoon, and two special steamers, chartered for the occasion by the local reception committee, carried from 400 to 500 gentlemen to the Seraing works, where, after being entertained to a splendid luncheon, they sallied forth to inspect the different departments. From a pamphlet thoughtfully provided by the directorate for the guidance and information of the visitors, and of which there were translations in both languages, we learn the following particulars respecting these magnificent works:—

The principal establishments of the Cockerill Company are situated at Seraing, six miles from the town of Liège, upon the carboniferous formation which runs through the territory. They occupy the estate which was used as a summer residence by the bishop-princes of Liège until the end of the last century.

The working of the Cockerill establishments comprises coal and iron mining, the reduction of the ores, the fabrication of cast and wrought iron and steel, the construction of machines and mechanical manufacturing engines, mechanical boiler, and the construction of metallic bridges and vessels. The Cockerill Company is managed by a board composed of five members, assisted by a director-general. The establishments comprise the offices for the direction, a special engineering service for the studies of construction, a library, a laboratory for analysing the raw materials, and form, as to the working, eleven special divisions, managed by chief engineers. The foundation of the Seraing establishments is due to John Cockerill, born at Haslington, Lancashire, on Aug. 3, 1790. His father had in 1799 introduced at Liège the construction of machines for wool spinning, and after having acquired there a great fortune had, in 1813, left his factories to his two sons, James and John. The coal and iron mining, the smelting of charcoal pig-iron, and wrought-iron workshops had been organised in the Liège territory for centuries. Besides husbandry and that connected with it, the working class of the country was mostly composed of coal miners, smelters, blacksmiths, cutlers, nailmakers, and lock and gun smiths.

In 1817 Cockerill Brothers bought from the Government (the Netherlands) the palace of Seraing with its appendages, and established at first works for the construction of steam-engines and machines for spinning flax, and afterwards a flax-spinning mill. In 1820 John Cockerill came to reside at Seraing, bought the grant of coal mines upon which the works stand, and took the proper measures to introduce on the Continent the smelting of cast-iron with coke and the fabrication of iron according to the English process. The working of the factory was then chiefly supported by the orders of the Government (the Netherlands). In 1824 magnificent steam-engines of 300-horse power were constructed under John Cockerill's supervision for the men-of-war of the country, while the English navy had engines of 150-horse power only. In 1826 the first coke blast-furnace, the furnaces, the rollers, the hammers, the blast-engines, and the engines for the iron factory were employed. The coal pits with powerful exhausting and drawing machines were set up in a state of enlargement hitherto unused. The first continental railway was decreed by the Belgian Government after the revolution of 1830, and the first locomotive was constructed for that railway, in 1834, by the Seraing works, which soon after supplied all the engines for the beginning of the Belgian network of railways. The Seraing establishment continued to increase rapidly until the demise of John Cockerill, which happened in 1840. It comprised in 1842, at the formation of the joint-stock company established to continue the operations of the deceased—1. The grant of coal mining with three collieries, furnished with all the exhausting and lifting-engines—2. 37 coke kilns of large size—3. 2 blast-furnaces with steam-bellows and grants of iron mines—4. A vast iron smeltery and a copper foundry—5. An iron factory with 35 reverberatory furnaces, 5 sets of rollers, the hammers, the divers steam-engines, the tools and apparatuses to complete the fabrication—6. An engine and boiler factory, containing 144 forge furnaces, 280 lathes and boring machines, 200 planing, grooving, tapping, and perforating machines, &c. There were 2200 employees and workmen; the moving power was equal to 920-horse power. The Seraing establishments had been placed in 1829, by John Cockerill, under the general superintendence of Gustave Pastor, his nephew, and the latter continued his services when the company was formed until 1866, at which time M. Pastor withdrew, and was replaced by M. E. Sadoine, chief engineer of the Government navy. The gradual improvements of the works, continually enlarged, have brought the productive powers of the various divisions to their present state. The works now comprise:—

COAL MINES.—4 collieries with 8 shafts for raising the coal to the top, ventilation, exhaust, letting down and bringing up the workmen by Fahrkunst, 24 engines together of 900-horse power, 2400 workmen (since 1867 women work no longer in the collieries of the company), annual production of fuel 350,000,000 kil.

COKE FURNACES.—4 groups, comprising 143 horizontal kilns, 12 groups, comprising 216 Appel kilns, 3 pounders, and 6 washers, 8 steam engines to pull out the coke, 13 steam-engines of 185-horse power collectively, 140 workmen, annual production of coke 140,000,000 kil.

IRON MINES.—20 mines in the Belgian provinces of Liège and Namur, in Luxembourg, and in Spain; 17 engines, equal to 306-horse power, 800 workmen, annual production of the mines 150,000,000 kil.

BLAST-FURNACES.—5 blast-furnaces, with apparatuses for heating; the air and tapping sheds for ordinary casting yielding annually 55,000,000 kil.; 4 blast-furnaces for steel pig now building, 15 engines collectively of 480-horse power, 300 workmen.

FOUNDRIES.—2 iron and one copper foundries, 2 workshops for earthen moulding, steam-crane, 1,000,000 kil. foundry frames, 8 engines of 90-horse power collectively, 210 workmen, annual production 5,000,000 kil.

IRONWORKS.—75 reverberatory furnaces, 12 rollers, 7 pounders, 55 engines of 1900-horse power collectively, 1240 workmen, 40,000,000 kil. in rails, girders, bar, and sheet iron as annual production.

STEELWORKS.—10 Bessemer converters from 5 to 7 tons, 6 of which are being mounted, 16 reverberatory furnaces, 7 pounders, 4 rollers, 48 engines of 3079-horse power collectively, 560 workmen, 17,000,000 kil. steel as annual production before the use of the unmounted apparatuses.

FORGES.—12 reverberatory furnaces, 7 pounders, 70 forge-furnaces, 5 engines of 288-horse power, 200 workmen, 1,500,000 kil. mechanical pieces as annual production.

ENGINE SHOPS.—363 lathes, mortisers, planers, perforators, tap-borers, 3 machines to forge bolts, and screw nuts, 2 hydraulic presses, moving cranes, stationary steam-crane and others, 20 engines, 1 pounder of 264-horse power, 1400 workmen, 7,000,000 kil. machines and mechanical apparatuses as annual production.

BRIDGE AND BOILER BUILDING.—55 drilling, arching, cutting, planing, canting, and clinching machines, 3 pounders, 54 forge-furnaces, 11 engines of 120-horse power collectively, 510 workmen, 6,000,000 kil. boiler, bridges of various kinds as annual production.

MISCELLANEOUS INFORMATION.—The area of the works is 200 acres, intersected with 22 kilometres railways of large section, and 12 kilometres of small—containing besides a basin communicating with the Meuse by a canal and 2 wharves. In 1872 there were 5912 people occupied, employees and workmen for all the works. There were 254 steam-engines of 7834-horse power in all. The wages paid annually amount to 8,500,000 frs. The consumption of fuel amounts to 350,000,000 kil. The production of the divisions is 25 to 30,000,000 frs. The establishment owns on the heights of Seraing, in a very healthy situation, a vast infirmary kept by nuns, it

holds 85 beds, a special physician is attached to it, and an orphan asylum containing a dispensary, which delivers medicines gratuitously to the persons attached to its works and their families. In each division there is a refectory established after the best manner for the meals of the workmen and the preservation of their food, some kitchens are added to several of these refectories, and some baths are put up at the collieries for the miners. Lastly, a society for relief and pensions is instituted, without being compulsory for the people of the works, and the establishment accords besides out of its funds temporary relief and pensions to the workmen and employees not concerned in that society.

The establishment, constantly improving, has from its foundation maintained the first rank for its various productions, as shown by its uninterrupted increase, the steady progression of its business, and its success in all the exhibitions in which it has taken part.

To each visitor, along with the pamphlet descriptive of works, a programme of the visit was given, showing the precise minute at which it was proposed to visit each department in order to see the different processes being carried out. The party was conducted through the works by M. Sadoine, the director-general, and although they went through their inspection with considerable expedition, staying only a few minutes in each department, it took four hours to complete it. There was nothing about any of the appliances or processes materially different from those of our country. It is noteworthy, however, that every possible economy appears to be studied, and the appliances, as a rule, are of modern construction and principles. The Bessemer Steelworks are splendidly fitted up, and when the extensions now in progress have been completed this will be a Bessemer plant second to none in the world. The reversing-engine in the rolling-mills attracted some attention. It is of a ponderous size, and does its work well. Some enormous cylinders were seen in different stages of construction. One of them, intended for a blast-engine, could not be less than 150 in. diameter. Few, if any, cylinders of this size are made in England, it being considered more advantageous when engines of this size are constructed to have two blowing-cylinders. In the smiths' shops there was ample ventilation, but little enough light. The machinery of the finishing-shops was very excellent, most of it made on the premises, of the most improved modern size and shape, and admirably arranged. There is a large colliery underneath the works, with its shaft a little to the right of the blast-furnaces. The depth of the shaft is 1500 ft., and the tubs took a minute to descend. The winding-engine was of very large size, and was covered, along with the whole of the shaft, by a large wooden roof. Every possible precaution is taken to prevent waste of coal. There are a number of Appolt's coke-ovens in operation, also within a few yards of the blast-furnaces. The material required for the charge of the blast-furnaces is broken up into small pieces, and mixed in relative proportions before being put into the blast-furnaces. The height of the furnaces is not more than 40 ft., and their production does not exceed 55 to 40 tons each per 24 hours. The temperature of the blast is 250° to 300°. Different qualities of iron ore are made, one kind for castings, another for sheets, plates, &c., and another for Bessemer steel. The visit was of the most enjoyable character, and although rather fatiguing, there was a general expression of pleasure and wonder on the part of members who took a share in the inspection of the works.

We reserve for next week an account of other works visited by the Institute.

THE DIAMOND ROCK DRILL.

Major BEAUMONT, M.P. for South Durham, and patentee of the Diamond Rock Drill, read the following paper upon that invention. The patents for the Diamond Drill are extensively worked by the Diamond Rock-Boring Company, the results previously obtained having removed the system from the category of experiment and established it as a recognised and practical success. As a rule, the company neither sell machines nor let them out on royalty, but contract, at a fixed price, for the execution of work. The business taken up by the company differs itself into four classes, in some of which greater advances have been made than in others. 1. The sinking of bore-holes for the purpose of testing or prospecting for minerals. 2. The driving of drifts, galleries, and tunnels, whether for mining, waterworks, or railways. 3. The sinking of shafts. 4. The removal of subterranean rocks by blasting. All of you will have a general idea of how these operations are carried on. Still, in order to enable you to value the results obtained with the diamond drill, I shall recall the leading features of the position in which the application of machinery stands with reference to them.

1. Bore holes are ordinarily cut down by giving a reciprocating motion to a chisel attached to the end of the rock, lengthened as the hole is deepened, the debris being brought up by means of shells or augurs. This reciprocating motion is given either by manual labour or by power. A constant, reliable, and risk attending giving even a moderately rapid reciprocating motion to a long column of rods; and to get over this difficulty and facilitate their withdrawal, Messrs. Mather and Platt have constructed machinery whereby the cutting is done by the fall of a cutting tool suspended from a rope—the great point of gain being the speed at which the necessary tools either for cutting or removing the debris can be lowered to their work and withdrawn. Attempts have, however, been made to supply a rotary motion to steel cutters, but even in soft rock the progress so obtained has been extremely slow, because steel can be got which will withstand the abrading action of the rock.

2. Headings are ordinarily driven by drilling holes and blasting them. Machinery is applied to the drills by attaching them to pistons (actuated by compressed air in cylinders, a supply of water to clear the debris and cool the tool being used). The air is distributed by a valve or valves, driven by suitable mechanism, and a rotating motion is given to the tool to obviate its striking two blows in the same place. All the processes of systems of boring machines in actual use come under the above description, varying in the greater or less degree of mechanical skill with which the pure force has been applied. Some machinery has been made which proceeds to drive tunnels at one operation, entirely by machinery, and without the use of powder; but hitherto, so far as I know, only a few yards have been so driven experimentally. 3. Drills, similar to those applied to tunnel driving have been used for shaft sinking, but only singly, and I have not heard of any case where the speed of the sinking has been notably increased. 4. The putting down of blast-holes under water has always been considered a most difficult operation, because a blow cannot be struck under water, and I have never heard of machinery being applied in this direction at all. I saw on the Suez Canal docks being removed by blasting, but the holes were put in by ordinary chain jammers, worked from barges anchored in the stream.

The diamond drill is in principle quite distinct from any other system of boring rock, and works by rotation, without striking a blow. Its action is rather that of abrading than cutting, and the effect is produced by the sheer difference in hardness between the diamond and the rock it is operating upon. There is really no comparison between the hardness of adamant and that of ordinary rock. If a diamond be kept rotating against a piece of sandstone it would cut a hole, (say) a mile deep, before it was seriously worn. It will be seen at once that this wonderful resisting power being properly taken advantage of, a machine can be constructed that will bore rock without striking blows. This enables machinery of the simplest and most ordinary character to be used, and thus avoids those special difficulties that the mechanic must face when he is driven to utilise a large power in the production of percussive action. Moreover, machinery can be applied in places where a reciprocating motion, if admissible at all, would present peculiar difficulties—such as making a hole under water, or putting down deep holes where, from the circumstances of the case, the cutter must be a great distance from the source of power. The diamonds that are used are not valuable gems, but carbonate—a substance that till lately had no commercial value, and was first introduced for the purpose of cutting other diamonds. It comes from the Brazil in small quantities, and though it has not been discovered in the Cape diamond fields it is more than probable that it exists there, and, indeed, wherever the diamond is found. You will see that its appearance is much like that of a piece of coal or dull jet, and as unlike as it is possible to be to its brilliant sister—the ordinary diamond—though chemists tell us that the two are identical in composition. I presume that the one is perfectly, the other imperfectly, crystallised, and, if so, it is no doubt this very imperfect crystallisation that gives to carbonate its value for my purpose, as it has no, or next to no, cleavage, and consequently does not split up and break in the way that a diamond or piece of hard wood would. This last statement, of which I hold a sample in my hand, is an impure diamond, and would seem to stand half-way between the brilliant and carbonate. According to the tables published in Crook's "Dictionary of Art," the following are the different specific gravities and degrees of hardness of some of the hardest stones:—

Substance.	Hardness.	Specific gravity.
Diamond from Ormus	20	3.7
Pink diamond	19	3.4
Bluish and yellowish	19	3.3
Ruby	17	4.2
Pale ditto from Brazil	16	3.5
Deep blue sapphire	16	3.5
Ditto pale	17	3.8
Topaz	15	3.2
Whitish ditto	14	3.5
Emerald	12	2.8
Garnet	12	4.4
Agate	12	2.6
Onyx	12	2.6
Quartz	10	2.7

Now, as there is plenty of corundum or rubies and sapphires in the market at mere nominal values, as compared with those of carbonate, I thought it could be advantageous to use in place of the latter, if only its hardness, as compared with the diamond, was anything approaching that which the tables led me to look for. On trying, however, both corundum and emerald, I found the above proportions altogether wrong in point of hardness; they were nowhere near carbonate. The trial that I put them to was as follows:—I set a piece of carbonate in a suitable holder, and held it against a grindstone; the carbonate turned the grindstone down. On trying the same experiment with the other minerals the grindstone was worn down. I am of opinion, therefore, that the diamond stands, in point of hardness or resistance to abrasion, if the two are not synonymous terms, at an enormous distance in advance of any other known material in Nature, and this seems a most remarkable fact. This application of the diamond to rock drilling is worked out as follows:—The stones are set in an annular ring, made of steel; they are fastened in by making holes as nearly as possible the size of the stones to be set, and then burying them, leaving projecting only the amount necessary to allow the water and debris of the cutting to pass. The metal is then drawn round the stone, so as to close it in on every side, and give as large a bearing surface as possible to

resist the tendency of the stone to be forced out. I may here say the loss from breakage and from the stones being torn out is far more serious than from wearing; in fact, with good stones having good broad running faces the mere wear is quite trifling. A stone breaking out is always a cause of danger to the others. The crown so set is attached to the end of a steel tube, and kept rotated against the rock at some 250 revolutions per minute. Water is supplied through the hollow of the bar, whence it passes under the cutting face of the crown to the surface of the hole between the side of the latter and the outside of the boring tubes; the diamonds are thereby kept cool, and the debris from the cutting is washed away. The crown has to be kept pressed forward with a force depending on the nature of the rock to be cut, varying from 400 lbs. to 800 lbs., when the cutting is done at speeds ranging from 2° to 4° per minute. Granite and the hardest limestones are easily cut at 2° to 3° per minute; sandstones at 4°; and quartz at 1° per minute. These speeds can be increased at pleasure, but I give them as representing the rates at which the drills are ordinarily seen in practice. On the table is a sample of pure emery, which was cut at the rate of 2° per minute. By a crown which I now hold in my hand, and which has bored through 6° of emery, 10 ft. of granite, and 95 ft. of hard sandstone, you will see that it is, so far as the diamonds are concerned, almost as fit for work as ever. The emery was cut out of a block put under the drill for experimental purposes, merely to show how great is the cutting power of the diamond. No rock is met with in mining that approaches emery in hardness; and, indeed, it would be a most difficult operation getting a hole put in it without a diamond drill.

At Mont Cenis the length of their machines precluded the possibility of angling, hence they were driven to obtain a first opening by putting down larger holes in the centre of the heading, which were not final. The diamond drill, being shorter, enables the drills to be angled, and the centre is blown without the aid of empty holes. I think it likely this is the cheaper plan, but I am not clear that the Mont Cenis engineers did not choose the more expeditious one, as the fact of angling means a loss of progress. In comparing the diamond system with the Mont Cenis or other good system of reciprocating drill, mounted on such numbers as to have a proper command of holding power, I do not contend that there is much advantage in any reasonable fixed time. I submit, however, that there is a certain gain, owing to the holes being true cylinders, and to the non-liability of the drills to break down, the machinery getting out of order being always a fearful source of delay. The great advantage claimed for the diamond system is its economy. No drills have to be sharpened, the plant is no more liable to get out of order than ordinary machinery, and the air in the motor can be used expansively, against which even more than counter-balance the fact that the motor must be kept running whether one or six drills are at work. The latter disadvantages are, however, running whether one or six drills are at work. The latter disadvantages are, however, running whether one or six drills are at work. The latter disadvantages are, however, running whether one or six drills are at work.

Mr. Brunel, the engineer for the Bristol Tunnel, is as follows:—
"Clifton Tunnel, Westminster, May 13, 1872.—Gentlemen: Last week I had the pleasure of seeing your Diamond Borer at work in this tunnel. The material through which the tunnel is being made is hard mountain limestone, with numerous joints filled with calc spar. The heading, which measures about 10 ft. by 8 ft., was previously driven by hand labour at an average speed of 1 ft. per week. The boring machine, during its first week of work, advanced the heading 36 ft., though the men only worked eight shifts, the rate of progress per shift being 3 feet. The result of the week's work was, therefore, nearly three times that attained by hand labour, and it is only reasonable to assume that when the machine men are fairly up to their work they will be able to bore 4 ft. per shift, and make 12 shifts per week. Hence there can be no reasonable doubt that the advance of the heading will become 48 ft. per week, or about 5 times that of hand labour. So far the diamonds show no symptom of wear, nor have any of them got loose in the setting."—JAMES BRUNEL.

The plans show the plant which is now about to be applied to sinking two pits, each 700 yards deep, for the London & North Western Railway, in South Wales. The plans are not yet ready to receive the machinery, or it would long have been at work. It will be seen that the principle is the same as that which obtains in the tunnel driving machinery—a pair of guides or standards carrying as many drills as can conveniently be put on, which latter are driven by a double cylinder compressed air engine, and each drill can be stopped and started singly. The system of working may be the same as that which I have described for tunnel driving, but as the diamond drill borer is a hole-drill well suited to the work, it is in contemplation to apply a new piece of machinery, the different circumstances which obtain in shafts, as compared with headings, render practicable. In place of drilling a series of holes 3 to 4 ft. deep the holes will be carried at one operation (say) 100 ft. deep. The machinery will then be removed, and the blasting continued, until the whole depth bored has been reached. The anticipated advantages of this system are that the machinery will only require fixing once; and, further, which is the main point, the operation of drilling can be carried on whether there is water in the shaft or not. Of course, 100 ft. is an arbitrary depth, and, as the drill never gets out of truth, there is no reason why the boring 200 ft. deep should not be done from the surface, or so soon as the rock may be reached. I quite admit that there will be no free side to blow to, or, in other words, the shaft will be lost; but in that case it will be easy to free it by putting in a few hand holes. I am given to understand that in America this system has been tried with very favourable results, and I hope shortly to test it fully. If successful, the enormous difficulty which dealing with water always presents will be materially lessened, and a considerable economy both of time and money will result in sinking shafts. As the most tedious part of the operation—the boring—can be done by machinery from the surface, and irrespective altogether of the question of water, I shall have much pleasure in communicating to anyone in Belgium interested in the subject the results that may be obtained. As regards the removal of subterranean rocks, the drawings on the wall show the plant now being prepared to carry out a contract for the removal of rocks in the River Tees. The contract is between the Diamond Rock Boring Company and the River Tees Commissioners. The work to be done consists of the removal of a long strip of rock, which is a terrible bar to navigation. It cannot be got away except by blasting, and to hole it by hand from a fixed stage would be a most costly and laborious operation. The plant consists of a large, supported on legs, a dust-hoist, a steam engine, and boiler, capable of driving 24 drills. That number of holes can be quite easily put down in a tide, as each hole is 1 ft. deep will not take more than an hour to drill. The dynamite, which is the explosive to be used, will be introduced through the same tubes which guide the drills, and the holes will be exploded so soon as the barge has been shifted to a fresh scene of operation.

The arrangements are such that the mines will be loaded and first without the employment of divers. A single drill has already been used on the rock, to cut it, and a few shots fired, sufficient to show that the desired interval of 10 ft. from centre to centre of the mines, the rock being sufficiently broken up for divers to remove it, and at the same time the action of the drill under water was seen to be perfect. I give a general sketch of the machinery used for prospecting, and which was specially designed to meet the case of a rough sea. The single pipe offers no resistance to the waves, and the power required to drive the drill can be conveniently taken from a barge or tug alongside by means of steam through a flexible tube. The Diamond Rock Boring Company are offering to undertake the removal of the Dainty Rock, near Cork Harbour, and other sunken rocks in other waters; and for this purpose the diamond drill is well adapted, as it is independent of the fact of its working under water or in air, and its being independent of the circumstances at which the boring may be carried on from the machine itself. In the limits of such a paper as this it would be impossible to go more fully into detail than I have done. The whole and sole claim to merit on the part of the diamond rock drill consists in the fact that the use of carbonate enables rotary to be substituted for reciprocating motion. Percussive machinery must, from its nature, be expensive, and in some cases it is especially difficult, if not impossible, of application. I have not alluded to the use of compressed air in tunnel driving, which is common to any system, but I may be permitted to say that the value of compressed air as an adjunct to mining is only now beginning to be properly recognised, and in proportion as it is introduced for underground winding, pumping, and other purposes, so it will facilitate the introduction of machinery for tunnel driving, as the compressed machinery necessary for setting drills in motion becomes a serious consideration when it has to be put down for that purpose only.

In the course of a short discussion that took place on the above paper, Mr. STREVENSON (engineer for Mr. L. Bell, at the Clarence Works), and Mr. COCKBURN (mining engineer at the Upleatham and Skinningrove Mines of Messrs. Joseph Pease and Partners, Cleveland), bore testimony to their experience of its value. Both gentlemen concurred in the opinion that the diamond rock-drill possessed advantages over every other system of boring, inasmuch as it enabled them to extract complete cores, showing precisely the nature of the strata being penetrated.

Major BEAUMONT hoped the time would soon come when they would be able by his machine to drive through galleries as cheaply as they now did by hand. This was a thing now much behind hand, but the time would come when they would be able to offer to the mining world a system of driving a wall much better, and not so much more expensive than that now adopted by hand labour. (Hear.)

The PRESIDENT thanked Major Beaumont in the name of the Institute for his paper, and remarked that he was now about to bore a hole of 200 fms. on his property at Port Clarence, near Middlesbrough, in order to prove the existence of salt. With the diamond rock-drill they hoped to be able to complete that hole in less than two months. (Hear, hear.)

ON THE OOLITIC ORES OF LUXEMBOURG.

Mons. A. HABETS read a paper on this subject. He stated that in 1871 the production of pig-iron in Belgium amounted to 610,000 tons, while the output of native ore did not exceed 100,000 tons, leaving the residue of ore required, reaching to nearly 600,000 tons, to be furnished chiefly from oolitic iron ores that were worked in the Grand Duchy of Luxembourg. Although situated on the same geological level, this iron ore does not occupy the same geological position as the main ironstone does in Cleveland, but corresponds more nearly to the top seam of the Cleveland district. Most of the French geologists call it the upper part of the lias, whereas the German and Belgian geologists place it generally on the basis of the inferior oolitic in the Bathonian system of M. D'Omalius. There are two different ores worked in the Duchy of Luxembourg, one is alluvial, and the production of it reached nearly 50,000 tons; whilst of the other, minette, the production last year amounted to 1,000,000 tons. Some works preserve the prejudice that the alluvial ores contain good qualities, and they add homopathic doses as a fluxing material, but this prejudice is being rapidly removed, although there are unmistakable traces of the ancient working of minette. In 1842 the blast-furnaces of La Providence consumed this ore; but the extensive employment of it dates back from the year 1862, which is

the period of the transformation of the old charcoal blast-furnaces of the Duchy into the large coke furnaces. The first blast-furnace erected specially for the employment of coke as a fuel produced from 15 to 30 tons per day. The whole formation may be divided into five groups:—1. Nancy. 2. Metz. 3. Grand Duchy of Luxembourg. 4. Longwy. 5. Halanzy Masson.

The ore is a hydrate of iron, mixed more or less with a siliceous iron, and the average quantity of metallic iron contained in it is 35 per cent. The proportion of phosphorus found in it is rather considerable. Some parts of it are very calcareous, others are very siliceous; while there are other parts containing at the same time both calcareous and siliceous seams. The ore costs on the average 3 frs. per ton at the furnace, and the carriage of coke from Liège as the centre cost 8 frs. 5 c. per ton, from the reason that the State has bought up the Luxembourg Railway. This is caused also by a duty of 1 fr. 50 c. per ton. The blast-furnaces of Luxembourg are in a more favourable position, as they are very near the mines, and there is very little to pay for carriage. The ton of ore costs about 2 frs. The carriage of ore from Liège to Esch actually reaches 7 frs. 25 c., which will be reduced to 6 frs. 100 c. in a very short time. There is no doubt covering the point of intersection of four different nationalities, giving rise to most interesting studies of national economy. The Chamber of Deputies, for example, would furnish a very good subject for consideration, particularly now when the entry duty of iron into Germany has been abolished, and this has been modified the condition of putting the French and Belgian blast-furnaces on the same footing, and the Luxembourg furnaces can now import their pig-iron into one of the most important markets of the world. That study, however, would be out of place here. The law of 1810 is still in existence in France as well as in Belgium. In France, however, the law of May 9, 1866, has abrogated the law of 1810 far as regards the distinction to be made between the mines worked by the proprietors of the surface, and the mines which are to be conceded by the State. Since 1860 it has been the practice in France not to grant any concession of iron ore deposits, but to reserve the right of the surface proprietor, who can work the mine on the day level system under the eye of the mining authorities, as long as he can make a profit. If the height of the cutting is great in regard to the richness, it may come to this—that the proprietors will work all the area before the concessionaire can be right given to him by the State. In Belgium the case has been decided by the law of 1837, which has reserved the concession of iron mines. The same law at present exists, so that the iron ore mines are not in reality conceded in Belgium. Commercial legislation has thrown obstacles in the way of the full development of the natural resources of the country, and the examples that have been given prove that even free trade is not sufficient to give to each country the full benefit of its resources, and also that it will be difficult to come to any agreement on the subject of mining legislation. The cost of the ore varies generally in Luxembourg from 1 fr. 50 c. to 2 frs. at the mine, and the actual selling price is about 5 frs. per ton on trucks. If we add to this the royalty the price will vary according to the locality from 10 to 30 per cent.

A vote of thanks was passed to Mr. Habets for his paper.

[To be continued in next week's Journal.]

ROYAL CORNWALL POLYTECHNIC SOCIETY.

The forty-first annual Exhibition of the Royal Cornwall Polytechnic Society opened at Falmouth on Tuesday, and continued during the week. Taken altogether, the exhibition may be pronounced quite up to the average. The fine art department is certainly every whit as good as last year, and representative in a remarkable degree of the works of western artists. A large and valuable collection of china has been brought together for the first time in the history of the society; and the less prominent departments of naval architecture, school production, and natural history are, upon the whole, a good average. But our chief reason for praising the exhibition, viewed more particularly in connection with mining, is that the exhibits this year were quite of sufficient importance to sustain the reputation of the society, and to keep up its character of practical utility.

Everyone who is connected with mining knows how important the provision of a generally efficient boring machine is. Something like a dozen have come at one time or another before the notice of the members of this society, and through the society, before the country. Last year the "Barleigh" drill won a good deal of favour, and was unquestionably up to that time the best of its kind. This year Mr. Thomas Warrington, who brought out the "Barleigh," has introduced the "Kainotom" (so called from the Greek *kainos*, new, and *tomos*, to cut), and that this for all practical purposes is a great improvement upon the "Barleigh" there cannot be a doubt. It is equally efficient, and at the same time it is cheaper and simpler. The latter point of extreme importance if such an implement is to be generally used in our mines. At the same time it is more economical. In the general principle of the Kainotom there is nothing particularly new. The borer is driven by a piston worked by steam or compressed air; and the feed may be either manual or self-acting. In the example shown at the Polytechnic it is manual, and when tried upon a block of hard Cornish granite holes were driven at the rate of 4 in. a minute. This disposes of the question of efficiency. Next as to handiness and economy. It is at once stronger and lighter than the Barleigh; and by doing away with stuffing boxes and all parts requiring constant attention and adjustment, there is a reduction in friction which enables the machine to be driven with much less power than 50 per cent. may be saved in providing pipes to conduct the steam or compressed air. Including all nuts, bolts, and screws, it only contains 42 parts, against 134 in the "Barleigh," and its cost as compared with the same implement is 86 s. 14 d., whilst its weight is only 160 lbs. These improved conditions fulfil so many of the requirements for successful boring mechanism in our Cornish mines that we are inclined to look upon the problem now as being practically solved. Mr. Warrington is also the manufacturer of air-compressing machinery. The Kainotom has received a first silver medal.

Economy in pumping is another most important consideration as our mines increase in depth; and here both Mr. Warrington and Messrs. Tangye Brothers come to the aid of the miner. Mr. Warrington obtained a first silver medal for Andre's patent hydraulic pump, a working model of which was shown. This is exceedingly ingenious, the idea being to do away with the need for numerous columns of water under pressure in iron pipes to suitably constructed pumps. The columns balance each other, and the only loss of power is, therefore, that due to friction, which will not exceed 3 per cent. Pressure is applied to the water columns at surface by means of plunger pistons or rams, working in suitable motor cylinders, and the water columns thus impelled move alternately corresponding rams in motor cylinders at the bottom of the mine, which work as pumps. The pressure-pipes are kept charged with water by an accumulator. There is no question as to the value of the principle, and that such machinery will ere long be introduced into the county is certain. Messrs. Tangye exhibit Tonkin's patent Cornish steam pump. Briefly, this may be described as an improvement upon the firm's well known and highly appreciated "special." The chief point of improvement is the doing away with extra tappet-valves, and the introduction of a supplementary plunger in the valve-chest. Mr. A. P. Vivian, M.P. (the President) spoke very highly, from practical experience, of Tangye's pumps in his opening address, and the pump was "highly commended." Tighman's sand-blast machine was awarded a first silver medal; Tangye's Hewitt's self-sustaining blocks, first bronze medal; John Hocking, for Cowburn's dead-weight safety valve, first silver medal; Wigzell's improved drawing boards, for stretching paper without using any adhesive substance, first bronze medal. An admirably made working model of the ordinary pump lifts and pitwork was shown by two young men who have been pupils of the Miners' Association—Messrs. John Letcher and Stephen Mitchell—who received 3d.

In one particular the exhibition differed most remarkably from

that of last year. There were no models of stamping apparatus. A drawing of "improved portable steam-stamps" was sent from Birmingham by Mr. T. H. Williams, but it was clear that the inventor, who adopted the Justice spring, was not so practically acquainted with the needs of Cornwall in this matter as to produce a really efficient apparatus. This was particularly to be seen in his arrangement, and his stamp, in fact, was simply a steam-hammer with anvil block, put upon removable wheels.

Mr. E. Borlase took a second silver medal with a beautifully made model of combined concave and convex buddle. The buddle looks well, and will be long tried in practice at Minera, Pen-an-trea, and other mines. It would be difficult to explain its mechanism in full detail without the aid of a diagram, but it may be described as consisting of four biddles arranged in pairs—one pair above the other, the upper pair consisting of a convex buddle in the centre, and a concave ring buddle surrounding it. Between the two there is a double circular launder, and, beneath, a pair of biddles precisely similar, except that the outer one is convex and the inner one concave. Beneath these, again, is an outer ring launder inclined, with two outlets, one for the ore and the other for the waste. There are in all six feeds—four around the outer upper buddle, and two for the inner— and the stuff is also washed off at six places. Although in the model only two separations are shown—ore and waste—yet more could be effected, and, practically, in the dressing of lead ore waste, blende, and lead would be kept apart. The economy of the arrangement is remarkable. Under the new arrangement 40 square feet of space only will be required to do the work which now occupies 250, and Mr. Borlase claims that it will be done more efficiently. So far as we can judge of a model, this really seems a substantial gain to dressing operations.

A patent ore separator is sent by Mr. Cox, of Penzance, the principle of which is remarkably ingenious. It may be described as a "water-tosser." It consists of a funnel-shaped hopper opening into a round tube or case below, the size of the annular opening into which is regulated by a plug worked by a screw. Water under a pressure of not less than 12 ft. is admitted by a pipe into the case, and rushes upwards into the hopper. The intention is to take the stuff direct from the stamps, and expose it to the action of the violently agitated water, the velocity of the water being so regulated that only the mineral would be of sufficient gravity to sink through the ascending column into the case. Here it would again be washed and cleaned from the slime, which would be carried back. Each separator is only calculated to deal with one size of stuff.

Mr. Marsden's Blake's stone-breaker, with patent cubing jaw, was highly commended. This implement has already received the highest award of the society, and we are glad to know that its use is spreading in the county.

Two inventions for raising and lowering miners were exhibited, one by model, and the other by diagram, but neither met the approval of the judges. One by Mr. Bural was for the hydraulic motion of reciprocating cages, and utterly unsuited, therefore, in spite of its ingenuity, for the conditions of mine shafts in Cornwall, to say nothing of other objections almost equally important. The other was a very clever idea by Capt. Rich, which received a prize of £10 for workmanship. Capt. Rich's proposal is to balance the pump rods by means of a man-engine rod, instead of balance bobs, and thus to economise power. The drawings were beautifully executed, and the conception is ingenious, but the judges were distinctly of opinion that it could not be carried out in practice.

There were few other matters of special local interest. Captain Maynard sent most interesting and valuable section drawings of West Wheal Basset and other mines, to which 21. 10s. was awarded. Mr. C. Minnear obtained a second bronze medal for an improved poll pick, the improvement in which consists in the increased depth of the eye. High commendations were given to Messrs. Quick and Simpson's improved piston; R. Bond's patent keyless railway chairs, in which the rail is secured by a screwed clutch-plate; Allen's patent governor; and the patent hydraulic lifting-jack and hydraulic punching bear of Messrs. Tangye, which are at once efficient and simple. Another exhibit of Messrs. Tangye was exceedingly noteworthy—Hewitt and Gough's patent self-sustaining rope blocks. By pulling straight downwards the weight may be raised or lowered; by pulling upwards a clutch comes into play, which effectually secures it. Messrs. Thwaites and Carbutt forwarded Root's patent rotary blower. One of the chief novelties was Tilghman's sand-blast machine, which was shown in action. The cutting or abrading medium in this apparatus is sand, driven against the surface to be operated upon by a jet of steam or air at a high velocity. By the use of stencil plates of iron or enameled glass may be engraved in the most delicate manner, and stone, wood, and metals ground, ornamented, or pierced.

There are several drawings and models of engines, or parts of engines, exhibited, and a few devices for ordinary domestic adoption. An improved window sash and frame for facilitating removal (J. Quick) received 14; an improved cooking stove, every part of which can be cleaned without removing the oven (S. Terrill) a first bronze medal; a like award was given to a model of a bookbinders' rolling-machine (H. Turner); and 17. to an improved smith's bellows, with valve to prevent return current (W. Messa); a rat-trap (George Rowe) was recommended for trial.

In the statistical department a first silver medal was awarded to Mr. A. K. Barrett for observations on elvan courses, accompanied by a map and collection of examples; and a first bronze medal to Mr. Goldsworthy's essay on the best mining machinery, which has been recently published in the Supplements to the *Mining Journal*. For a patent unsinkable folding boat, covered with india-rubber, Mr. James Verran had a second bronze medal.

The inaugural address was delivered by the President, Mr. A. P. Vivian, M.P., in the Hall, on Tuesday, in which it will be seen he makes special reference to the coal question.

The President commenced by remarking that he must apologise for venturing to occupy a chair which had been filled by men of such superior calibre and world-wide reputation; amongst whom no family stood higher in a scientific or social point of view than that of which his predecessor—Mr. Charles Fox—was an illustrious member. That gentlemen's presidential address showed his great learning and respect, and he (Mr. Vivian) felt the difficulty and, indeed, hopelessness of attempting to interest them as Mr. Fox did. The primary object of such a society was the encouragement of science and art—worthy anywhere, but peculiarly worthy in a county like Cornwall, where so large a proportion of the inhabitants were directly or indirectly concerned in mining and commercial enterprise. One of the chief objects of the society was to encourage the application of scientific learning to the practical wants of the surrounding interests (by which so much had already been done), and this was to be effected to a great extent by a judicious system of high award practical inventions exhibited at the annual meetings. In these days of high wages the application of science to practical purposes was more than ever needed, and, indeed, essential, in order that Englishmen might cheapen production, and avoid, if possible, the loss and removal to other countries of many of their national industries, as he feared to see the cost of coal, from which we have all been suffering more or less during the past year. What use is it that we are told by the report of the Coal Commission that our supplies under the surface are nearly practically unlimited, if the cost of production in bringing it to the surface is such as not only to make it disastrous to private households, but ruinous to the mine; or to the carrying on of certain industries for which we were formerly famed; or to the driving such industries from our shores into foreign lands. It may be said that it is sincerely to be hoped, that science will come to our aid in the same way in which it has done before in this very industry, when Sir Humphry Davy, of whom this county may well be proud, invented the safety-lamp. It may be that some practical coal-cutting machine may be invented or brought into use which will economise that most expensive item of labour, and thus meet in some degree the very great increase of cost which has taken place lately. At present these matters seem to answer well in what is called the "flat measure"—that is where the strata are horizontal. Here they work with greater economy of coal, get out more tonnage for the same amount of labour, and are equally successful where the colliery is situated in the "steep measures." They may, however, and no doubt will be, further perfected. And now, while on this subject, I would refer for a moment to the report of the Coal Commission as it appears in a national point of view. The Commission report from evidence they have had before them, that under a system of working now largely adopted, called "long wall" working, they anticipate that the coal working may be carried on to a depth of 4000 ft. They arrive at this from the following facts:—That the temperature of the earth is constant at a depth of 50 feet below the surface; that it will be difficult to carry on work except with gangs of men each of whom would work for a very short time, at a depth where the temperature would be over blood heat, or 95°; that the depth at which this would be at the ascertained rate of increase of temperature is about 2000 feet, but under the long wall system of working a difference of about 7° appears to exist between the temperature of the air and that of the strata at the working falls, and this difference represents a further depth of 400 feet, so that the depth at which the temperature of the air would under present conditions become equal to the heat of blood would be about 3420 feet. These figures, looking to possible expedients which the future may elicit for reducing the temperature, the Commissioners considered it might fairly be assumed that a depth of at least 4000 ft. might be reached. Again, an extensive use of coal-cutting machines,

worked by compressed air, may have the effect of enabling men to work cooler at greater depths. My opinion is that the depth at which coal may be worked will depend to a very great extent on its market value—that is to say, that if consumers can afford to give large increased prices, the depth at which it will be worked will go on increasing. But in all probability another cause will interfere with the operation of these natural causes—and it will be found that foreign coal will be able to be imported at a cheaper rate than we can produce it ourselves from excessive depths. The Commission further reports that the loss in working or winning under favourable circumstances is 10 per cent., while in a very large number of instances it is 40 per cent. Their estimate of quantities of available coal is as follows:—In ascertained coal fields of the United Kingdom, 90,207,000,000 of tons; at available depths under the Permian, New Red Sandstone, and other superincumbent strata; 56,273,000,000—making a total of 146,480,000,000 of tons—equal to 1273 years of our present consumption of 115,000,000. The question of a constantly increasing consumption with increase of population is open to so many causes of variation that I will not trouble you with further figures, beyond stating that in 1855 our home consumption was 59,339,557 tons, while in 1869 it was 97,006,409, or 3 tons 17 cwt. per head of the population against 2 tons 14 cwt. in 1855. So much for the report of the Coal Commission. Besides the quantity of valuable technical information it gives to the country, the great moral which the nation may derive from it is—that although our national coal cellars are practically almost inexhaustible, yet that our consumption is increasing enormously, and that it behooves us to do all we can to check the waste both in obtaining it and using it—the first, as I have said, is known to vary from 10 to 40, or even 60 per cent.—i.e., in winning or getting 100 tons of coal from 10 to 60 tons are wasted. Surely this requires our best consideration and attention. I have no doubt waste in using will mend itself sooner than that in getting, and nothing will do more towards this than the present and past high prices. As a proof of this, I see it stated that in the first four months of this year London consumed 50,000 tons less than in the corresponding period of last year—notwithstanding the increase of population. I know, too, that the extraordinary reductions have been effected in the consumption of coal in many large factories and smelting works. I will not take up your time with more about this coal report, but I deemed it my duty to allude to it, as being, perhaps, the technical publication of greatest interest which has appeared for a very long time. (Applause.)

Mr. Vivian then proceeded to say that as to the advance made in different branches of science, they had only to take up any scientific periodical to be really astounded at them; and at how they were being brought to practically benefit the world at large. One day they read of some comparatively unknown country, like Persia, being brought into instantaneous communication with themselves, and that the Shah, when in England, could amuse himself in the day by calling up his ministers in Persia out of the beds in the night. What could be more marvellous than that not only was time thus bridged over, but that the message was recorded and printed by the same power. The theory of John Wesley, then deemed the fancy of an enthusiast, that lightning itself would be made man's servant and messenger, was indeed come to pass. Another day the vast strides chemistry was making would rivet the attention—and that was not only a theoretical but a most practical progression. It could be shown that the drainage of the large towns could not only be made innocuous, but that what was before the source of disease and death became of great use and agricultural value. After allusions to the progress in photography, astronomy, and other sciences, Mr. Vivian went on to comment upon the principal characteristics of the Exhibition, dealing chiefly with the mechanical department. It was a great mistake, and one which the English were too apt to make, to trust entirely to the practical rule of thumb and pay too little attention to the scientific laws of Nature. Science was already used largely as regarded the special industries of the country in the dressing and the smelting of ores, but he did not feel at all certain, particularly as regarded the former, that more could not be done. The Germans paid the greatest attention to this department, and some of their recent publications testified to the importance they attached to it. Good and intelligent men, as many of the Cornish dressing floors were, it must not be imagined they were perfect. Even the Cornish engine, of which they were so justly proud, and which had obtained so wide-spread a reputation for economy in fuel, must be closely looked after in order to keep its place in the race of the world. It was always a matter of difficulty where there were many exhibits of merit to select any for special mention, but he could not refrain from calling particular attention to the following as being of peculiar interest to this country. The Kainotom boring machine appeared to be very well adapted for quarrying purposes. Another patent hydraulic mining pump, if found practically to answer the purpose for which it was intended will be of great value. There was Tangye's patent pump. He had had one of these at work pumping water in a colliery in Wales, and found it to answer perfectly. Then Mr. Borlase's concave and convex biddles were most ingenious in construction. Any invention for the improvement of the preparation of ore should receive the greatest encouragement from the society. The American blast was an exceedingly ingenious invention. Mr. Cox's ore separator demanded notice, as did the collapsing lifeboat, which he thought might be employed with great utility. Root's rotary blower was important. The bellows shown were clever, and he did not think economical in use; and Messrs. Mitchell and Lecher's pump model would teach more in a few minutes by sight than whole pages of description. The makers were pupils of the Miners' Association. After commending Capt. Maynard's mine section, and Mr. Barnett's elvan course map, Mr. Vivian, in conclusion, referred to the magnificent collection of china, for which the Society was indebted to the exertions of Miss Fox.

Original Correspondence.

GAULEY-KANAWHA COAL COMPANY.

SIR,—I have just observed an article on this subject in the Supplement to the *Journal* of Aug. 16, and as I was quoted in the prospectus as having reported on the property of the company, I think it due to myself to say that the use of my name was entirely without my authority or knowledge.

I know Gauley Mountain intimately, but as it contains several thousands of acres, and as this property is described as only 1000 acres, I have no means of identifying it. Generally speaking Gauley Mountain is exceptionally rich in coal, as it contains several valuable beds, which are elsewhere lost by erosion; also, where the native forest is left standing, the timber is magnificent. But what is the value of wealth that is inaccessible? I quite concur in the statement made by "Carbon," that instead of the Gauley river "being navigable for barges at all times of the year," it is not navigable at any season, and could not be made so without works of the most costly character. It consists of a series of pools and shoals, and ultimately debouches into the Kanawha above the falls.

Although the unauthorised use of names is most improper, and notwithstanding the fact that the statements as to accessibility are untrue, I am still most unwilling to believe that the vendor was actuated by any fraudulent intention. His vindication lays in the mode of payment, if (as I am informed) it consists solely in deferred shares. Now, if these shares are still in his own hands, and he has not either sold any of them or made them the basis of any financial transaction, it will be pretty evident there has been no dishonest intention, although the course adopted has been most injudicious and improper. It is much to be regretted that gentlemen of previous standing and reputation should put forward extravagant statements; it not only mislead confiding investors, but naturally checks legitimate enterprise, by surrounding all other things with an atmosphere of doubt and disbelief.

J. BOWRON.

New City Club, Lombard-street, Aug. 21.

THE GAULEY-KANAWHA COAL COMPANY.

SIR,—Having received the accompanying letter from Gen. Imboden since your last issue, and as it bears on the case of the Gauley-Kanawha Coal Company, will you be good enough to give it insertion in next week's *Journal*?

A. STUART, Secretary.

Queen Victoria-street, Mansion House, Aug. 27.

TO THE DIRECTORS OF THE GAULEY-KANAWHA COAL COMPANY (LIMITED), LONDON.

GENTLEMEN,—I reached home the day before yesterday, and avail myself of the first post to write to you. When we parted on the 16th ult. in London, I expected immediately on reaching home to send you an abstract of title, &c., and prepare for immediate work. Judge of my indignation on learning that a day or two before my return a most outrageous and libellous attack had been made on the company by a little newspaper, the *Carrier*, published in Charleston, Kanawha County, and that the parties making this assault had sent copies to England, and telegraphed the *Times*. I was astounded till I saw the articles, and received to-day information shedding light on the motives that prompted them. The object was to destroy this company at its birth, and defeat investments by Englishmen in the Gauley Valley till after the Kanawha River lands are all first in process of development, and secondly, by driving the English off, to depress the value of Gauley River lands by a "bear" movement in favour of a "ring" of New York coal-land speculators interested in keeping down prices till they can buy all they want. To-day I have information that leads me to believe that I can prove this base motive for the attack. I have retained two of the ablest lawyers in Virginia and one at Charleston to prosecute and sue for damages the authors, publishers, and circulators of the libel, and next week I proceed to Charleston with my counsel to institute the suits. So far as I am concerned, there is more than money involved in this matter. My character is at stake, and I mean to vindicate that, and punish as far as I can the libellers.

I am not willing to send you the deeds and ask their acceptance by the company till after one of your own body, or someone selected by you, comes over here and goes upon the spot to verify the truth of the reports and statements of facts upon which the company was raised in England. I now suggest that for a short time, till this can be done, you deposit the company's funds at interest. It will take but a short time to make the verification, and I hereby agree that if the property is not found to be in all respects as it has been represented, I will pay all the expenses of the party who comes over to make the examination, and will make the company a free gift by deed of all my right, title, and interest in the land. And I believe I may safely say that Mr. Moody will do the same thing. And I now ask you to accept and act on this proposition.

I learn that Mr. M. F. Maury differs widely from me in his estimates of working expenses, and I understand that on July 14, two days before I left England, he posted to me his estimates, and sent a press-telegram to his brother, I will write the letter to hand his copy over to you, as I presume Col. Davies will re-post mine. I must say in regard to Mr. Maury's estimates, as I understand them, they are far more excessive than mine can possibly be under the mark, and several items which he charges to this company will be incurred by the Chesapeake and Ohio R. R. Company and the Gauley River Navigation Company as soon as we can guarantee

that we are going to work. But I expect no difficulty in getting the C. and O. R. R. to run a branch to our mines, as they are now doing to others far away. In a few days I will inform you on this subject, as I have made an appointment to meet the vice-president of the company early next week. I should like, if possible, that Professor Ansted should be sent out by the board. I should drop all other work, and go with him whenever he comes. My chief regret about this newspaper attack is the delay it causes. The suits I shall bring will not only vindicate me and the company, but in the end will redound to our advantage, as all the facts will go into the records. I will keep you advised of all that transpires, and hope soon to see Prof. Ansted here, or some other member of the board. I. D. IMBODEN.

Richmond, Virginia, Aug. 2.

DEVELOPMENT OF THE WARWICKSHIRE COAL FIELD.

SIR,—The excursion into the Warwickshire coal field by the South Midland Engineers, of which you gave some description last week, is so noteworthy a circumstance in respect of coal and ironstone mining, and is calculated to produce so important an influence upon the development of the iron industry in the West Midlands, that I thought you would like to publish a sketch of the proceedings by one who was present. The Warwickshire coal field, as Mr. Parton pointed out in his paper, is by no means new either to the geologist or to the miner. It was Mr. Parton who drew attention to the fact that the Bedworth locality, where so much activity is now being displayed, was the place where in about 1600 Camden says coal was being worked, and that "the miners assured him large toads had been found in the solid rock." Bell pits are traced along the outcrop; and if Bradley, in South Staffordshire, has the right to claim to be the first to use steam in obtaining the blast for smelting iron, it is at Griff, near Coventry, as you last week intimated, where in the year 1711 steam was used for drawing purposes at a colliery.

Prof. Hull, Mr. Parton has shown, gives the following as the general succession of the formations across the centre of the Warwickshire field:—

TRIAS.	
1.—Red Marl	Feet 600
2.—Lower Keuper Sandstone	150
3.—Bunter Sandstone, only sparingly represented	—
LOWER PERMIAN.	
1.—Brown and purple sandstone and marl, with calcareous breccia and conglomerate, with <i>strophodont</i> and <i>habyrithodon</i> and plants	2000
COAL MEASURES.	
1.—Sandstones and shales, at the base of which a band of limestone, with <i>spirifer</i> <i>carboviridis</i>	50
2.—Coal measures, with five workable coals lying near the centre of the series	1400
3.—Lower coal measures unproductive of coal, and traversed by dykes of greenstone	1500
MILLSTONE GRIT.	
1.—Hard siliceous rock, with bands of shale altered with intrusive greenstone, about	500

The workable coals, which are at about 1000 ft. below the limestone above mentioned, and that furnish, it is estimated, 418,000,000 tons yet to be gotten, are separated in the northern part of the coal field by about 120 ft. of shales and sandstones. These gradually thin out southwards, making the aggregate at Wyken nearly equal with the marvellous one seam to which Staffordshire owes its fame and its prosperity. I am indebted to Mr. Parton for the following detailed section of what is to be found at Bedworth:—

Feet in.		Feet in.	
Two-yard coal	6 0	Fire-clay	1 0
Fire-clay	0 7	Coal (state)	2 1
Bare coal	2 0	Bat (state)	0 3
Rider stone	0 6	Coal (state)	4 6
Weller coal	0 6	Fire-clay	2 0
Rider coal	4 0	Black marl	1 0
Ell coal tops	1 8	Lady coal	3 0
Parting	0 10	Binds and ironstones	32 7
Ell coal	3 11	Seven feet coal	4 6

In the northern portion of the Warwickshire field coal winning has in modern times been prosecuted industriously and successfully; and about Bedworth the Hawkesbury Colliery Company have a long time been at work displaying much enterprise. One sinking of theirs was conducted at a cost of 60,000*l.*, and even then had to be abandoned, so difficult was it to deal with the water and the moving strata, notwithstanding the use of powerful iron tubbing. For many years the wonderfully abundant argillaceous stone of Warwickshire has been carried to the furnaces of South Staffordshire, and there smelted. That they are abundant would appear from the section in which binds and ironstone are set down at a total of 32 ft. 7 in. The stone, which is as rich as it is abundant, is sometimes found in masses of 5 tons. These monster balls it was difficult half a century ago to deal with. Now, however, the knowledge of dynamite enables them to be risen with comparative ease, and to be brought up in remnants easy to transport. The Staffordshire men who had any previous knowledge of the Warwickshire field were very delighted at the marvellous richness of the product; and, immense as the yield is, yet were quite prepared to believe that as much as 13 cwt. of ironstone per square yard of working is yielded by some pits of the Bedworth Co.

With an abundance of coal, and with such ironstone, there should be no cause for surprise that a firm of Staffordshire ironmasters, who have long been hampered by the rapid exhaustion of the minerals of their own field, have determined to make iron in Warwickshire. The Bedworth Company means Messrs. Addenbrooke and Mr. Millward chiefly; and Messrs. Addenbrooke are the firm of ironmasters of that name who have long been one of the foremost members of the coal and iron trade of South Staffordshire, whilst Mr. Millward has for many years been their chief engineer. Messrs. Addenbrooke have shown, perhaps, more than any other firm in South Staffordshire a disposition to avail themselves to the fullest practicable extent of all the aids which modern science and recently applied mechanics afford for the profitable smelting of the Staffordshire stones. It was not, therefore, likely that they should be intimidated by the unsuccessful 40 years back of one of the early founders of the Hawkesbury Company, who, after putting up a blast-furnace on the property which the Bedworth Company now own, had to abandon it because of the difficulty of obtaining on the one hand proper admixtures of stone, and upon the other of inducing the native labour to give more attention to the furnaces than to the beer barrel. Relics of this old furnace lay strewn about the field, memorials of the difficulties with which our ancestors had to deal when the science of ironmaking was in its infancy, and railways were not. The very richness of the ores of Warwickshire defeated the old ironmasters, who knew not the value of some of the leaner seams of their county, and of the yellow and brown ores of Northampton, for mixing purposes. Both these last and many others are now, however, available to the modern ironmaster, who has likewise found by experiment that for calcining and coking purposes he possesses near to his rich ironstones a description of coal upon which at one time no value whatever was set.

There is no reason, therefore, why the two excellent furnaces which, at a cost of quite 20,000*l.*, the Bedworth Company have erected should not prove largely profitable. The set should be regarded as models for adoption in South Staffordshire and Warwickshire. Without possessing any special novelties, they embrace all the modern improvements, including the economising of the gases upon the Addenbrooke and Millward principle, which, I may add, is now being largely used; mostly, however, is this blast-furnace plant of the Bedworth Company notable in respect of the height of the furnaces. I need hardly say how anxiously this question of height has been debated lately by foremost metallurgists. It is one of great importance as affecting the economical production of raw iron, and more than at any former time it is this phase of the question to which the ironmaster will have to give his attention. The height of the furnace of the old Staffordshire type, adopted before the consumption of the gases was dreamt of, and the existence of Cleveland as an iron-producing country altogether unknown, was 50 ft. When the northern ironmasters had run up theirs to 70, and 75 and 80, and in some few instances to even 90 ft., and had declared that these altitudes were the best, Messrs. Addenbrooke in Staffordshire experimented by raising one or two of their furnaces to, I believe, 70 ft. With what success appears from 50 ft. having been adopted in these model erections. The coke produced by the Staffordshire and Warwickshire coals are too tender to bear the weight which 70 ft. would impose; and the Cleveland masters, if I am not mistaken, find that all the heat they require can even with the strong Durham coal that they use be obtained most economically by the height of the furnace being limited to from 70 to 75 ft.

What is now taking place at Bedworth further illustrates the old miner's aphorism—that when new minerals are wanted they will be forthcoming. What could not be done at the beginning of this cen-

tary can now be accomplished with comparative ease. The fuel and the ironstones of Warwickshire are now of great practical value, and the increased light which the modern ironmaster obtains from the experiments of recent times, together with the decrease of supply from the neighbouring field of Staffordshire, have alike contributed to this end. The activity in the Warwickshire field, and the extended available supply in Staffordshire arising out of the operations of the local mines drainage scheme, should together assure the local iron consumers and fuel users that they need not fear an exhaustion within a reasonable period of those home minerals upon which their prosperity has hitherto depended. For there can be no doubt that the Bedworth Company will prove pioneers. It may be that in the Bedworth locality they have the cream of the property as well in respect of depth as in relation to convenient railway and canal transit; but now that the visit of the South Midland Engineers to the Warwickshire pits has drawn especial attention to that field, mining enterprise will see in it a means of activity which is sure to be prosecuted primarily to the advantage of the traders in the district, and of the investing capitalists, and ultimately to the benefit of the whole nation. An early display of this enterprise should be looked for at that end of the field where the coal again crops out at the surface.

I do not think that the visit has done much to determine the question of the correlation of the Staffordshire and Warwickshire coal fields, which is a debatable problem upon which the further development of the Warwickshire field will throw the most light. Anything that can be accomplished towards the elucidation of the subject is of great importance, inasmuch as it will be another step towards removing the doubt which still hangs over the unproved ground between the known portions of the two fields. Certain of the seams, as well of ironstone as of coal, are very much alike in both fields; indeed, appear to be equivalents one of the other. The correct correlation of the two fields must, nevertheless, await the further research as well of the skilled geologist as of the practical miner.

Still, whether or not the two basins prove hereafter to have been one of the same, the inspection by the South Midland Engineers has, I think you will agree with me, done good service in drawing prominent attention to a district respecting a portion of which Prof. Hull has said—"If we now come to the districts east of the 8th Staffordshire coal field, we have there, when looking for a continuation of productive seams of coal, to guard against the uprising of the Silurian rocks along the original margin. But as the seams of coal have been shown by my colleague, Mr. Howell, to range continuously along the Warwickshire coal field as far south, at least as far as Coventry, there can be no question that north of a line which I should be disposed to draw from Coventry to Walsall we have a region of productive coal measures."

OBSERVER.

THE McKEAN ROCK DRILL—DYNAMITE.

Sir,—The admirable manner in which the McKean rock drill continues to do its work induces me again to trouble you to insert another letter upon the subject. The rock in which we are now boring is so excessively hard that the "Titanic Steel" will not stand before it; and as the drills are made of the titanic steel, which flies to pieces like glass, we have been obliged to steel them with Cookson and Co.'s (of Newcastle) "double shear" steel (65s. per cwt.), which, owing to its being as tough as it is hard, stands perfectly. As the forehead at present it would not work at 14 ft. per fathom, by hand and with powder; yet our men, without hesitation, took a bargain at 5s. 10s. per fathom, and have in four weeks and three days completed 8 fms. Sixteen holes, including a few necessary hand holes, will, with dynamite, cut a fathom of ground. To anyone interested in mining operations it is well worth a journey into these remote parts to see the beautiful manner in which the machine works, and the marvellous power of the dynamite, three charges of which, in a hole 6 feet deep, will lift 2 ft. of rock from end to end. For another supply of this best and safest of all explosives I have had to send to Relear, 50 miles distant from the mine. My extreme gratitude to the late Minister of the Home Department and the North-Eastern Railway Company is beyond expression. Notwithstanding the increased expense of the dynamite caused by these obstructions to its transport, I can now assert that the cost of driving a level with dynamite and the McKean rock drill will be less by two-thirds than by hand, while the men can earn much better wages, with very easy work. During the above four weeks, with the exception of oil, the machine has not cost a penny for anything; and if I had a sufficient supply of jumpers I believe the smith could in one day sharpen enough to last us a week. I commend Cookson's best double shear steel to all miners, whatever may have been said at the Iron and Steel Institute about any other steel.—Aug. 25.

G. W. DENYS.

ECONOMISING FUEL.

Sir,—As I observe that you have noticed one of my inventions—that relating to the manufacture of iron with hot coke and gas—I may mention that this forms one of a series of three, all of which have for their chief object the economising of fuel; and from the extreme importance of the subject, I have thought well not only to send copies of the three specifications to the proper Government officials, but to accompany them by an explanatory note, in which I state that the immense consequence of the subject is increasing fast in ratio, and explain how my inventions are calculated to meet the difficulty. I do not believe the area of coal in this country adequate to bear the enormous present waste without inflicting present and permanent injury of the greatest magnitude.

The cost of fuel is, as it has often been stated, much affecting the staple manufactures, and I fear that in ensuing severe winters the poor may suffer intensely from insufficient firing. The increased cost for labour in staple manufactures (such as iron) and the increased cost for fuel will, I consider, at a quickly increasing rate stimulate and open out the mineral and manufacturing resources of foreign countries, and curtail the manufactures for exportation of Great Britain; and as to some of those foreign countries, such as Russia, Japan, &c., the resources of coal are immense. In the United States of America the beds of coal and iron ore are gigantic in extent and thickness, and it is only hitherto the relative scarcity and dearth of labour and material available, as compared with this country, which has retarded their development, and prevented the United States to a leading extent from supplanting England. Now all this is balanced, and unless there is a radical alteration will be more than balanced.

Coal is, and as I believe it in chemistry will be, as it were the soil or foundation stone of manufactures, and a basis, in fact, of civilisation itself; and this country, with its great wealth, the great debt upon it, vast population, and comparatively small extent and thin beds of coal, requires economy in the use of such a fundamental mineral, and certainly will not admit of the wholesale waste of it that I maintain is current. The force of English character, its mental power, and its capability for and exercise of hard heavy industry, with the country's resources of fuel allowing the development of them, have caused it to keep the lead in foreign markets, but have also caused an immense increase of population, and now this population is competing with such manufacture for fuel for warmth and domestic purposes.

When the iron smelter wants samples of ore analysed or tried he either does so by wet process or by the gas blow-pipe—commonly, for practical purposes I believe, by the latter, as it gives him power of heat that he cannot obtain by experimental coke furnace. I have long been surprised that the more scientific iron smelters have not themselves gone on the palpable initial idea thus given, and instead of allowing the most valuable fuel imaginable—that is, coal gas—to be all distilled off and wasted from the coal (the coke from which they use for smelting), they have not availed themselves of it, and used practical blow-pipes, as well as heated solid carbonaceous matter or carbon in the furnaces.

The competition for fuel, as between manufactures and physically heating purposes, caused privation of warmth to the poor last winter, and I fear that, especially in great cities like London, there would if the winter had been very severe have been sad cases of death from cold starvation, and there appears to be the same prospect in ensuing winters. I consider that it will be a great pity for the country not to stir itself, but to apathetically go on in the present wasteful way; if it do so now, it certainly will not be found to deserve sympathy

in its dolorous complaints and lamentations about coal, and will have to bear whatever burdens and deprivations neglect of scientific appliances and extravagant use or waste of fuel may cause, for "Wilful waste makes woeful want."

WM. MICKLE.

Market Deeping, Aug. 18.

PEAT AS FUEL—No. I.

Sir,—Peat, that kind of semi-decomposed vegetable matter, has of late been frequently alluded to, both in the Press and in the proceedings of various societies, and the public begin to look upon it as a good fuel, which, being turned to no useful account, is practically wasted and lost. Under these circumstances I need hardly apologise for venturing to state my own views on this subject, which I have derived from many years' study and practical experience. I may add that, in submitting these considerations to the appreciation of the public, I am solely actuated by the desire of contributing my humble share, rather to the ventilation than the solution of this important fuel question, now engrossing the attention both of producers and of consumers. It is admitted on all hands that it would be a great boon to many poor districts in which immense tracts of peat are found if a good, portable, and cheap kind of fuel could be made out of it. Ireland, for example, with its 3,000,000 acres of peat land, and its immense iron deposits, would be benefitted beyond calculation if a simple and easy method of this description could be devised; so would England itself, France, Belgium, Holland, Germany—indeed, every country, for peat exists everywhere.

Now, it is well known that there are two great drawbacks militating against the utilisation of peat as fuel. In the first place, the smell it evolves while burning, and the comparatively large quantity of it that must be dug out to obtain a given quantity of useful and proper fuel, are circumstances inviting the most serious considerations. Again, the lightness of the prepared fuel, its porosity, the fact of its making only a dead fire, and the large quantity of ashes remaining after the fuel is burnt, and which ranges between 1 and 30 per cent. of its weight, must be looked upon as so many obstacles in the way of its general adoption. Still, I believe that, with a thorough knowledge of all circumstances of the case, many of the difficulties enunciated may be overcome, and a full knowledge can only be got at if everyone who has studied the subject contributes his share to the elucidation of the problem.

Before going *in medias res*, it may not be useless to advert to the actual composition of raw peat, to ask ourselves what may be the intrinsic value of its many components, to examine the various methods tried for utilising one, or several, or all of these; in fact, to revert to the initial stage of the question when it was first discovered that peat was a substance that could be turned to some useful account. Peat, as it now exists, shows us on a small scale what was the condition of wood when that slow decomposition commenced of which coal is the ultimate product, only the circumstances are changed. The weather, the temperature, and the meteorological influences in general, such as the chemical composition of the atmosphere, &c., are now quite different from what they were several thousands or tens of thousands of years ago. Still, the ultimate decomposition of peat needs yield the same products as that of wood—viz., carbon, hydrogen, oxygen, and nitrogen. By being put under or exposed to or damped by water, the small plants that form peat undergo a slow decomposition, water and carbonic acid being formed; the same did happen when, under the enormous pressure of the atmosphere which is admitted to have been at work in the period alluded to, wood was first decomposed into wood-coal or lignite; indeed, there exists a great analogy between those two products, peat and wood-coal; both emit an offensive smell when burning, both are very hard to dry, &c. Some years ago Mr. Oxland tried to utilise the subsidiary products resulting from the decomposition of peat, but he found the expenditure to exceed the returns. On the other hand, Mr. Reece has succeeded (whether economically or not, he does not say) in extracting from peat ammonia, acetic acid, pyroxilic spirit, tar, naphtha, oils, and paraffin.

Mr. Bagot, at the exhibition of 1871, claimed to have obtained out of 100 tons of raw peat—firstly, 10,000 gallons of a liquor containing ammonia, carbonic acid, acetic acid, pyroxilic acid, and pyroxilic spirit; secondly, 1000 gallons of another liquor, containing tar, paraffin, and heavy and light hydrocarbon oils, the gaseous products being carbonic acid, oxygen, hydrogen, and nitrogen, leaving a residue of about 50 tons of charcoal. The quantity of illuminating gas is stated to have been 6269 cubic feet, whether per ton of charcoal produce or for the whole it is not said.

The Irish Peat Company, started some 20 years ago for the distillation of oils, obtained from 775 tons of raw material, and in addition to the residue of charcoal:—

	excts. lbs.
Ammonia.....	24 28
Naphtha.....	7 75
Lubricating oils.....	116 25
Paraffin.....	232 59
Being for every ton of undried peat—	
Ammonia.....	3 1/2 lbs.
Naphtha.....	17 2 1/2 lbs.
Lubricating oils.....	34 4 1/2 lbs.

The most important feature of these results, however, consists in the 1000 gallons of liquor obtained by Mr. Bagot. They gave him—
52 gallons of pyroxilic spirit;
200 lbs. of paraffin;
200 lbs. of naphtha or hydrocarbon oil; and
100 gallons of heavy oils.

Of the money value of these products I shall speak by-and-by, for the present it is sufficient to state that such products were obtained.

Upon analysis I have generally found peat in its raw state, and of good quality, to give per cent.:—

Paraffin.....	915
Naphtha.....	901
Heavy oils.....	950
Pyroxilic spirit—acetic acid.....	926
Fixed carbon.....	44,000
Mineral ash.....	8,500
Water.....	37,108

The water contains the ammonia and carbonic acid. I have always found a great difficulty in procuring peat, dried in the open air, in such a state as not to contain more than 20 per cent. of water. When washed with a large quantity of water, and at different times, peat is deprived of its ammonia, and of all its soluble constituents, together with a large percentage of its oily parts, and the residuum is comparatively easier to dry, and has, when dry, a greater specific gravity.—25, Finsbury-place, London, Aug. 27.

A. VASSARD.

SLATE QUARRYING IN ANGLESEA.

Sir,—The Secretary of the Llanfawlyn Slate and Slab Quarry Company complains of my comments on the notice, in the *Mining Journal* of August 9, of the formation of that company, and, calling in question the justice of my remarks, quotes various authorities on the definition of the term "Slate" in support of the statements I found fault with. I am sorry I did not call those statements "incorrect" instead of "fallacious," and I admit that his complaint that my quotation was imperfect is a just one, though that was more a printer's error than mine, as in my letter I indicated in the usual way—by dots—that the sentence was not complete, which marks were unfortunately left out by the printer. The words omitted, however, are not very important in the question whether slate-rock similar to that of the best Festiniog slate quarries is found in Anglesea.

In referring to my letter, I do not find the assertion "that no rock similar to the Silurian formation is found in Anglesea." Such ignorance would have been surprising in the youngest tyro. My remark is that "the member of the Silurian strata in which the only valuable Festiniog slate quarries are" is not found in Anglesea; and my authority for this opinion is not "any old geological map or treatise," but the Government Geological Survey of North Wales, and some personal acquaintance with the island, which, though not very minute, is sufficient for me to know that there are no really successful slate quarries working there. Mr. Sykes's description of the Llanfawlyn stone is certainly very favourable, but, though I do not deny the possibility, I still doubt the probability of its being either "superior" or "similar" to the Festiniog slate rock, and fear, in spite of such literary authorities as Webster and Dana, and his friends will find, whilst "slate" is "an argillaceous stone," that

argillaceous shale, even if it satisfies Dana's requirements, is a true slate, and, if he will excuse the hint, that 10,000,000, is rather an extravagant price to pay for the opportunity of making the experiment. In the latter part of his letter your correspondent shows that he has gained some information about slate quarries and the slate market, though I still doubt his practical acquaintance with either. If he pursues his enquiries further I think he will find, however great the present demand for Ladies' slates—16 by 8—the profit of a slate quarry is derived from the larger sizes, which are proportionally much more valuable, and are saleable when the smaller sizes are a drug in the market.

In conclusion, time will show who is right in this controversy, and Mr. Sykes will, of course, put his own value upon my warning. My chief object in writing is to protest against the very constant habit of advertising everything except a slate quarry as the same or similar to those at Festiniog. This, when the rock is "superior," is unwise to do; but when, as is more frequently the case, the description is neither geologically nor commercially true, the practice is unfair, and is calculated to injure this district. Having a tolerably extensive knowledge of the slate districts of North Wales, as you are aware, whenever statements of the kind, as incorrect as I to my notice I shall ask for space in your columns to contradict them, leaving the public to pay attention to the contradiction or not, as they think proper.

August 28.

A FESTINIOG SLATE QUARRY PROPRIETOR.

THE NOVA SCOTIA GOLD FIELDS.

Sir,—The following items from a letter dated Goldenville, Aug. 18, may be of interest to the readers of the *Journal* who follow the progress of gold mining in this much overlooked mineral region:—
"The WELLINGTON MINE has improved since the last taking down of the lode. I have not seen such rich specimens of gold the last five years as were hauled up yesterday."

"The CLEVELAND MINE is doing well on the Hamilton lode."
"The EXCELSIOR has 35 tons of quartz ready for the mill, but no water to crush with. We are prospecting on a new lode never before seen. It is a fine-looking lode, but has not shown any gold yet."

"The mines in this locality are giving good profits, and if worked in a proper way would well remunerate the adventurers."
"Capt. Sprague, at Wine Harbour, is doing very well on the Bonaville, and his prospects are first-rate."

ACADIANUS.

THE MINERAL RESOURCES OF SPANISH AMERICA.

Sir,—American mines have lately engaged much attention in England, but it has been chiefly to the silver and silver-lead mines of Utah, most of which have resulted in disaster, so far as returns have been made up to the present. It ought to be known to the public that Spanish America is the most metalliferous region in the world. Long after the old mines of Europe are worn out the Spanish colonies of North and South America will supply Europe with metals, and even with the precious metals. What may be called English America is very rich in minerals; the eastward west ranges of the Rocky Mountains abound in metalliferous treasure, especially iron, copper, lead, and silver, and gold it is well known is plentiful in the new State of the American Union called California. New Mexico is rich in silver and lead, but there have been no adequate means of working put forth except in a few instances. Stretching away from the boundaries of the United States, Spanish America affords a grand field for enquiry as to its mineral resources. The range of the Cordilleras abounds in metals, and further south the Andes are rich in metallic treasure. This is true of both the eastern and western slopes of these ranges, which are virtually one and the same facts of their mineral resources.

In our present notice we desire to call attention simply to the peculiar resources of those parts of America colonised by the Spaniards. The most northern of these is Mexico. The riches of this region in silver have been long known to the world. It is supposed, but not proved, that there are auriferous districts on both slopes of the Cordilleras. Some lead and silver-lead deposits have been discovered "here and there," but it is only lately that the world has awakened to the stanniferous deposits of this great but imperfectly worked metalliferous sphere. When Humboldt, the memorable German philosopher, travelled in South America he recorded his opinions of Mexico as to its geological characteristics and mineral resources. He described it as one of the great argentiferous regions of the earth, but he also represented it to be the chief of the stanniferous spheres. He declared that tin would be found over a large area of the Spanish Province, and it was reserved for a later period to prove, indeed, all Humboldt wrote about South America has been corroborated by practical men connected with modern enterprise.

Putting aside for the present Humboldt's account of the argentiferous treasures of Mexico, which have been written about, we had almost said *ad nauseam*, let us look at the tin-bearing properties of that great Union of States. The western slopes of the Cordilleras have not been adequately explored, in truth, very little attention has been paid to them, but on the eastern ridges and sides of this range tin has been found in large quantities. Humboldt pointed out the site, and subsequent experiments confirmed the opinions of the great geological and mineralogical scholar. In one particular region at the foot of this mountain range tin is found in streams, gullies, ravines, and the alluvial earth all around these ridges and currents to a great extent is saturated with beads and blocks of tin, swept down from the lodes by the floods in the rainy season. Tin is found in the beds of the rivulets left naked when the rainy season is over, and where eddies are found, and also in the alluvial far away around, in atoms from the size of a bean to an egg-apple, and occasionally to that of a man's hand. Of course, wherever there is stream tin stanniferous lodes must exist in the higher ground, and it is according certified that heavy tin lodes exist in the neighbouring heights; and if the same geological phenomena exist there as in Cornwall, copper will be found in successive layers to tin.

The Mexican Tin Mining Company will probably solve many questions connected with Mexican mining. The company has been but recently formed, and its object is to bring tin to the English market; but its resources and intelligence will enable it to do more than this, and it is obviously destined to write a new chapter of Mexican metalliferous resources, as well as bring to England tin supplies ample in quantity and superior in quality. The Mexican tin ore gives a yield of 70 per cent. of sound tin, and the stanniferous region is within easy access of the Grand Trunk Railway of Mexico. The Mexican Tin Mining Company has a fair field, and will require no favour but that which the public accord to every reasonable enterprise requiring investment.

Passing over the Central States of South America, for it is impossible to treat in a single article upon the whole, and setting aside Portuguese South America (Brazil) as not coming within the scope of this article, the chief mining regions of South America belong to the slopes of the Andes, and the plains adjoining. The Republic of La Plata are the least rich in minerals of any kind of all the South American States—the Banda Oriental being in this respect the poorest of those Atlantic States. Paraguay is very rich in iron; some of the purest in the world is to be found there in great abundance. This is the only metal sought by the Paraguayans, and the country has been so little explored by geologists that it is impossible to say whether mineral resources of any kind, except iron, are to be found there. The Argentine Confederation was once famous for argentiferous ores, but very little is now obtained. The Province or State of Buenos Ayres is without metals, and the other States of the Union or Confederation have been little explored. It is, however, likely that Entre Rios is mineral, but on the borders of Paraguay, and in Santa Fe, there are indications of metalliferous rocks. All the Pacific States are rich in metals of almost every sort. Peru has gold and silver and precious stones.

Chili is the richest copper field in the world, but it is not only copper which it yields, silver-lead and iron are found, but it is to copper that the mining industry of Chili is directed, and her exports of the metal to the United States, and especially to England, are immense.

Bolivia, taking into account the variety and extent of its metallic

THE GREAT LODE AT TREGARDOCK MINE, CORNWALL.
SIR,—The Supplement to your valuable Journal has just been sent me by my son, from Wales, in which I see some remarks on the above lode and mine from Mr. N. Ennor, and that he would cut it for 50*l.* at sea-level. I must beg to tell him that his uncalled-for letter is well understood by me; its whole contents is to me as discord between me and my employers; as they tried to force me to work at a similar remarks that I had lost my dial and had hauled my level to the North Sea, which was quite untrue, and they had paid me for the services of my employers visiting the mine, and would not have had mine to make Mr. Ennor pay their expenses and that they had brought with them. Little has been done since, as the mine has fallen into new hands. I must beg to tell Mr. Ennor that he knows nothing about the correct bearings of the lodes in this mine, and that, furthermore, I beg to state that the main lode he talks of cutting for 50*l.* we are now driving on, and have got good lead. There is a branch sprung off a small distance ahead of us, which will form a junction with the main lode we are now driving on. However, as I have but a few minutes more to write to save this post, I will reply more fully to his

when the night boys were absent through sickness, I went down to the bottom of the mine, and saw that the ore was quite unbottomed, as the drifts and shafts proved. For going below I was threatened to be dismissed the mine, but very shortly after this, when ore could be shipped down the canyon, a rush was made to get ore, and all the men put on three shifts, working night and day, the men being fed in the mine like pigs; then I had full opportunity of seeing the mine above and below.

When I left the Emma I considered, with the then rate of working, the mine would be cleared out in two months, as they had about 30 ft. high of rich ore; when this piece of ore was worked away or cut through the Emma Mine would resemble a large, high, empty, storehouse—16 empty floors. The Illinois Tunnel appears another part of the swindle, as that was started and worked by Mathews, the then superintendent of the Emma, one of the captains, and some of the Emma old shareholders. I believe that tunnel was started and ended in what we call in Cornwall "an agreed job," and just carried on for a spree with these parties, and a few lawyers and judges, who in America live on the bribery principle. When I arrived in Salt Lake City from the mine I informed different parties as to how the mine stood, including Mr. O'Brien, agent for Bath and Son, Swansea, who were buying all the ore, and Walter Brothers. The company's offices were then at their store, and Mr. Smith the secretary. All these parties well knew the Emma was nearly cleaned out, and it is hard for me to believe that Mr. Brydges Williams, with his experience of mining, could go in the Emma, and not know that the mine was cleaned out.—*W. EMMET, junr.*

[For remainder of Original Correspondence see to-day's Journal.]

Meetings of Public Companies.

THE VAN MINING COMPANY.

A general meeting of shareholders was held at the mine, on Tuesday.—Mr. THOMAS CLEMENT MUNDEY in the chair.

Mr. W. J. LIVINGSTON (the secretary) read the notice convening the meeting.

The CHAIRMAN said he was gratified to again meet the shareholders, but at the same time wished that he could have seen present a greater number.

The SECRETARY then read the report of the directors, as follows:—

The directors have much pleasure in submitting to the proprietors the accounts for the past half-year, fully certified by the auditor.

There has not been any charge against capital account, the credit balance of which remains as before, 1111. 6s. 1d.

The sales of lead ore amount to 2790 tons, producing 46,411. 2s.; and of blende 950 tons, producing 4232. 10s., making together 45,643. 12s., being 3499. 10s. in excess of the previous half-year.

The expenditure for labour cost, merchants bills, royalty, rent, income tax, and interest, amounts to 25,343. 15s. 6d.; being 2581. 4s. 8d., in excess of the previous half-year.

The result is a profit on the half-year's working of 23,299. 16s. 7d., which, added to the balance, 1283. 13s. 1d., brought forward from the previous account, makes 24,583. 9s. 8d.

Two dividends of 1s. each per share have been paid, and there remains a balance of 583. 9s. 8d. to credit of new account.

The prices obtained for the produce of the mine compare very favourably with the former periods.

The agitated state of the labour market, and the high prices ruling for coals, iron, and other materials used in carrying on the works, have caused the expenditure to be unusually heavy.

It will be seen from the manager's report that the mine is in a very efficient state of working, and is looking in every way most satisfactorily.

Your directors continue to be well satisfied with Capt. Williams, and feel assured that under his management the very best results will be realised.

Mr. Robert Oldrey retires from the direction in rotation, and being eligible, offers himself for re-election.

The auditor, Mr. J. H. Whaley, also retires at the meeting, and being eligible, offers himself for re-election.

The accounts were then read, showing that during the half-year the sales had been 2790 tons lead, and 950 tons blende, realising a total of 45,643. 12s., the average price obtained for the lead being 16l. 16s. 3d. per ton, and for the blende 27. 7s. 10d. per ton, resulting in a total profit for the six months of 23,299. 16s. 7d.

The agent's report was then read, as follows:—

Aug. 25.—As under, I beg to submit to you my half-yearly report upon this mine giving you a general statement of the work done since your last half-yearly meeting in February. Seaham's engine-shaft is sunk 12 fms., and is now 15 fms. below the 80, or a total depth from surface of 65 fms. 9 in. We are now deep enough to put forth our 75 cross-cut below adit, but, as usual, before commencing to cross, we shall sink another 3 fms., in order that when we resume the sinking for the 90 we may be able to do so without interrupting operations at the 75. We hope to accomplish this and have the 75 cross-cut driven in to intersect the lode by about the end of February next. I am happy to inform you that judging from what is seen going down in the bottom of the 90, we may reasonably expect to cut a rich lode at the 75 fm. level.

The 40 Fathom Level: This level has been driven west of Seaham's shaft a distance of 23 fms., upon the main leader of the lode, which is worth on an average 100l. per cubic fathom for lead ore. The same level east of the said shaft has been extended 17½ fms., of which 9½ fms. have been driven upon the main leader, and is worth for lead ore 50l. per cubic fathom. Finding the main leader very hard and spare for driving, we turned the level to drive upon the south part of the lode, and have driven 5 fms., which is worth about 40l. per cubic fathom. Our object in doing this was to push forward as quickly as possible to communicate with a winze sinking on the bottom of the 45, in order to obtain ventilation.

The winze is only 6 fms. ahead of the present end. We have not thoroughly intersected the lode at any point in the 50, but shall do so as soon as we can secure better ventilation, although we have at one point proved it to 14 ft. wide. You will see from the foregoing that at this level we have laid open to 3 fms. 3 ft. of ore ground since your last meeting.

The 45 Fathom Level: This level has been extended in the last half-year 19 fms. 2 ft., upon the main leaders, and is now 94 fms. 2 ft. west of the old engine shaft, or 101 fms. 2 ft. west of Seaham's shaft. For this 19 fms. 2 ft. the lode is worth on an average 100l. per cubic fathom. The winze known as the 57 fm. level winze, west of shaft, is sunk below this level 13½ fms., and for the last 3½ fms. we are sinking in a rich lode for lead ore. The discovery of lead in this winze is an important feature, indicating a wide and productive lode at this point at the 45, inasmuch as the bottom of the winze at this level should be 6 fms. south of the footwall of the lode, but, in my opinion, it is only a feature characteristic of this lode, for where it bulges out or expands into a sort of big belly it is there very productive, which no doubt is the case here. The 45 east of shaft has been extended 24 fms. 1 ft., upon the hanging of the lode. We have crossed into and tried the lode at several points in this length, but discovered nothing worth valuing. The total length of this level, east of shaft, is 55 fms. 1 ft. We shall not be very long now until this level is driven within reach of the ore ground seen in the old workings. A winze for the purpose, as before-mentioned, of ventilating the 45, which is only 4 fms. short of reaching this point. During the past half-year our stopes have been extended 30 fms., 10 fms. east of shaft and 20 fms. west, and have also taken down the lode to full width for a length of 5 fms. at the western end of the stopes. The stopes in the back of this level east and west of the shaft, 14 in number, are on an average 19½ ft. wide. In some places they are worth from 100l. to 150l. per cubic fathom, but taking a fair average of all they are worth about 90l. per cubic fathom.

The 50 Fathom Level: This level has been extended east of shaft 18 fms., and now measures 55 fms. We have cross-cut through the lode at different points in the said 18 fms., but made no discovery sufficient to value. A winze has been sunk at a point 74 fms. east of shaft for the purpose of ventilating the 45. The same level west of shaft now measures 135 fms., and in the present end we are cutting nice branches of lead, yielding saving work. This seems very much like as if we were just skimming the top of a run of ore ground, and I am of the opinion, from the indications here, that our 45 will hold rich up to this point. A rise has been put up in the back of this level to the 15, at about 5 fms. behind the present end, for ventilation. The winze sinking below this level, known as the 59 fathom level winze, has been communicated to the 45 west of shaft, and now affords good ventilation, as before-mentioned, of ventilating the 45, which is only 4 fms. short of reaching this point. The cross-cut driving from the old shaft to Seaham's shaft has been driven 25 fms., and is now within 3 fms. of communicating with the latter shaft. When this is accomplished it will be of great service to the mine. The stopes in the back of this level, 10 in number, east and west of the shaft, are on an average 20 ft. wide, and worth 31l. 10s. per cubic fathom.

The 15 Fathom Level: This end is now 143 fms. east, and is for the present suspended. The lode in the back of this level, although showing occasional spots of ore, is not worth valuing. The stopes in the back of this level, east and west of shaft (three in number), are worth on an average 14l. per cubic fathom for lead, average width 26 ft. The permanent levels have been pushed forward at the different points with dispatch.

Surface: The agent's house has been built and slated. We have constructed eight large lime-pits, in addition to the 20 before constructed, for filtering the water after it leaves the dressing floors. We have also extended and built several culverts, &c., on the several floors. We have nearly completed the raising of the embankment of the reservoir an additional 3 ft., which will give us (when completed) that depth of water over an area of about 7 acres. This is a very valuable addition. We intended accomplishing this last summer, but it being so very wet the water did not sink low enough for us to be able to get the stuff out for doing it. All our engines and machinery are in good working order. We have bored out the cylinders, and repaired most of our engines, so that they are now almost as good as new. We have also renewed one 10-ft. diameter water-wheel and one propeller blade. We sampled on Monday last 500 tons of lead ore and 150 tons of blende, the produce of the last four weeks, which is for sale on the 25th inst.

In concluding, I would remark that so far the mine has spoken for itself, but it may naturally be asked—What about the future? In my great pleasure in saying that the mine never presented a more permanent and lasting appearance than at the present time, I could we ever boast of such enormous reserves as we now have.—WM. WILLIAMS.

The CHAIRMAN then stated that he should offer only a few brief remarks, as the accounts and reports so fully set forth the position of the company. He was pleased at being able to congratulate the shareholders upon the future prospects so ably put forward by their manager. The price of lead had been good throughout the half-year; not so the price of blende. The secretary, as usual, had handed him figures showing the ore sold since the present company took possession, from which it would be seen that from the commencement the company had sold 20,610 tons lead and 5110 tons blende, realising together 201,168. 14s., and had paid in dividends 144,750l., that

during the last half-year being equal to 38 per cent. on the capital of the company. He was prepared to answer any question that might be put relative to the mine or the accounts, and concluded by proposing that the accounts and reports as presented be adopted and circulated amongst the shareholders.

Mr. HURRELL: One thing strikes me in looking over the balance sheet, and that is the expenditure on account of cottages. Now, I believe this outlay has been most judicious, and I would urge on the directors the desirability of building more.

The CHAIRMAN: We have no intention of building more at present.

Mr. HURRELL: Nevertheless, I hope the board will keep the subject before them.

The CHAIRMAN: We certainly will, should the opportunity occur of increasing the number.

Mr. F. HUNT: Are there any liabilities against the company not charged up?

The CHAIRMAN: No, there are none.

The resolution was then put and carried unanimously, as were also those relating to the retiring director, Mr. Robert Oldrey, and appointing Mr. H. J. Whaley as auditor for the ensuing year.

Mr. F. HUNT proposed, and Mr. REID seconded, a cordial vote of thanks to the Chairman and directors for their attention to the interests of the company during the past half-year.

Mr. HURRELL would propose just one resolution more—a vote of thanks to Capt. Williams for the efficient manner in which he had managed the mine during the past half-year. It was his pleasing duty to propose a similar resolution at the last meeting, but, having to-day gone through the mine, he felt incumbent upon him to say that he was gratified beyond measure to see the admirable manner in which every part of the mine, both above and below ground, was managed.—Captain WILLIAMS then briefly returned thanks, in which he gave it as his opinion that the mine would be richer on the day of the funeral of the members present than at the present time.

This concluded the business of the general meeting.

An extraordinary general meeting was then held, Mr. THOMAS CLEMENT MUNDEY in the chair.

The CHAIRMAN said that before subdividing the shares, as proposed in the notice of the meeting, it was found necessary to insert the words "or lesser" in clause 24 of the Articles of Association, thus giving the company power to carry out the alteration.

Mr. PAGE seconded the resolution, and said it had been represented to the board by some influential shareholders that the subdivision would be found beneficial to the company; hence the proposition.

Mr. HURRELL could see no objection at all to the proposed alteration, but, on the contrary, thought it might be the means of increasing the shareholders.

Mr. REID could see no objection either, but thought that, having a good thing, they did not wish all the world to participate in it; at the same time, he did not in any way object to the proposition.

The resolution was, therefore, carried.

The CHAIRMAN, in proposing the second resolution, said that it had been the custom of the directors to hold a meeting on the surface works, as also the meetings on the opportunity of visiting their property. It was, however, but sparsely responded to, and the board thought that an alteration making the meetings yearly instead of half-yearly would be desirable.

The resolution was seconded by Mr. PAGE, who stated that the sales were originally made every calendar month, but lately an alteration had been effected, and they were now every four weeks. This gave 13 sales in the year, and the board found it impossible to accurately divide the year in two parts, but although meetings would be held only yearly, many unforeseen delays have occurred, but the works are now in such a forward state that the directors hope the whole will be completed and in full operation by the day of the meeting. The directors believe that the time has arrived to close the capital account of the company by the issue of the remaining 1000 shares, and they propose to submit resolutions to that effect to the shareholders, at an extraordinary meeting to be held for that purpose on the same date, and immediately following the annual meeting. They further propose to offer them *pro rata* to the existing shareholders in the first instance at 3s. each, and have made arrangements with responsible parties for the disposal to them of the whole of these shares at that price, or of any portion which may not be taken by the shareholders. By this means the amount may be considered as secured, and the unexpended capital of the company available for the future prosecution of the mines may be stated to be 4500l. This sum, in the opinion of the directors, is more than ample to bring the mines into a dividend state, and will indeed form the nucleus of a proposed reserve fund, available for any contingency which may occur. The directors take this opportunity of recording their satisfaction with the progress and improved position of the works throughout, and of reiterating their formerly expressed conviction that the mines will prove a source of lasting profit and prosperity, and that, at an early date, some returns will be made to the shareholders from the time when the shares are now about to commence. Since the last meeting, upon the disqualification of Col. E. S. Daniel, the board elected George Livingstone, Esq., to fill the vacant seat. That gentleman now retires in accordance with the Articles of Association, but being eligible, offers himself for re-election. The director retiring by rotation is J. J. Lynch, Esq., who, being eligible, offers himself for re-election. The auditor, Mr. D. Forrest, also retires, but being eligible, offers himself for re-election.

The report of Mr. R. Harvey stated that the water-wheel has been pumping some time, and answers exceedingly well. The new drawing machine, with pulleys and stands, are fixed, and only waiting the arrival of the rope from the contractor. The jigs machine is in a forward state, and will be completed this week. The jigs machine is in a forward state, and will be completed this week. The jigs machine is in a forward state, and will be completed this week.

The engineers have begun fixing the stone-breaker. The whole of the machinery and connections are now on the mine, and I do not see any obstacle to prevent the contractors completing the whole of the machinery before the end of the present month, when dressing operations will be at once commenced; and now, having the enormous reservoir completed and full of water, we shall be prepared at all seasons of the year to work the mine and dressing works with any interruption.

In conclusion, he congratulates the shareholders upon the improved prospects of the mine during the past twelve months, and should the improvements continue as for the last twelve months, and with the aid of our present machinery, I have no hesitation in stating that this mine will stand second to none in the Principality.

The details of the meeting will appear in next week's issue.

EXMOUTH SILVER-LEAD MINING COMPANY.

The quarterly meeting of shareholders was held at Bristol, on Tuesday.

Mr. G. H. BOWYER in the chair.

The SECRETARY (Mr. R. Trevithick) having read the notice convening the meeting, the minutes of the last were confirmed.

The accounts showed that the debit balance last quarter of 427. 1s. 2d. had been reduced to 376. 3s. 10d., while the liabilities and assets showed a credit balance of 113. 19s. 8d. The captain of the mine (Mr. John Cook) reported as follows:—

Aug. 26.—Our great object, as you are aware, has been to ventilate the north part of the mine from the cross-cut, with the hope of opening up a good and lasting mine in addition to the south part, which we have been and are now working. From the cross-cut to Williams's shaft, on the north boundary, is about 150 fms., with 50 fms. back, which has never been proved by either rises or cross cuts. The adit is cleared through, and the rails laid. Williams's shaft is cleared and secured down 20 fms., leaving 20 fms. more to clear, when done will give us good ore to cross cut, rise, or drive anywhere we may think proper. This 20 fms. we contemplate doing by sinking the shaft 10 fms. deeper, and rising 10 fms. on the lode, and drive to meet and so hole the ground at the 40. We have air pipes in to the end of the adit drawing air to the air-shaft at the end of the cross-cut. The shaft being only 50 fms. and the pipes 150, and having to take the air from the cross-cut, it does not draw so strong as we could desire. The air is little, but it is good. The men have commenced rising to day. I hope as the weather becomes cooler we shall receive a benefit from that also, so as to get through before the wet comes in. About 40 fms. south of the cross cut we have repaired an old rise from the deep adit and the shallow level in the old workings. In driving a cross-cut we have gone through three lodes, but poor. We turned on the second, and have driven about 10 fms. on the lode, which will pay for stopping. I think we shall obtain some good tribute ground here. Our stopes south are yielding about their usual quantity of ore, averaging about 5 cwt. of lead per fathom. The levels, roads, and dressing machinery are all in good repair, and working well.

The CHAIRMAN, in proposing the adoption of the report and accounts, said he was sorry they could not show a better balance-sheet. There was only 113. 19s. 8d. to the good, which was not sufficient to declare a dividend on the present account. Looking, however, at what other mines were doing, he thought they were more lucky, on the whole, than most and better than many. With the present high prices of iron, labour, &c., and the low price of metals, it was difficult to get good results. He trusted that on the next occasion they would have a better balance-sheet to lay before the shareholders.

The motion having been duly seconded, Mr. STEVENSON asked whether credit had been taken for everything up to date—whether the accounts showed the present position of the mine?—The SECRETARY: So far as we know.—Mr. STEVENSON: Then we have 113. 19s. 8d. to the good. Is there a reasonable prospect of declaring a dividend next time?—The SECRETARY: Yes. Last time we declared a dividend when in debt; now we have a balance in hand.

Mr. STEVENSON: The balance in hand is equal to a dividend of 6d. per share. Is there any way of reducing the expenses?—The SECRETARY: We always try at that, but we do not see our way to cut them down.—The CHAIRMAN: We cannot lower the wages; the tendency is the other way.—Mr. STEVENSON: Is lead falling or rising?—The SECRETARY: The prices are tolerably good now.

In reply to Mr. PAINES, it was stated that there might be some extra work to do this quarter, and that the north part of the mine had not been explored.—The SECRETARY thought they had been lucky, as they had only spent 7s. 6d. per share.

The motion for the adoption of the report and accounts was then put to the meeting, and unanimously adopted.

Messrs. Bowyer, Stevenson, and Marks were elected the committee of management for the ensuing quarter, on the motion of Mr. Fox, seconded by Mr. Paine. The CHAIRMAN returned thanks, and said the committee would do the best they could for the mine.

Miss MORSE enquired whether the mine was progressing?—The CHAIRMAN said the accounts showed a balance of 113. 19s. 8d. in favour of the mine.—Miss MORSE: When will a dividend be declared?—The CHAIRMAN: You have just had one of 6d. per share.

After some further conversation the proceedings terminated with a vote of thanks to the Chairman.

EAST WHEEL SETON MINING COMPANY.

A general meeting of shareholders was held at the mine, on Aug. 22. Mr. THOMAS PRYOR in the chair.

The accounts showed a debit balance of 1298. 11s. 6d.

The report of Captains Pascoe and H. Arthur stated that since the last meeting, held on the mine on May 20, we have forked the water at Emily Henrietta from adit to the 90 fm. level, and have put in the dam at the 80 against Wheel Cock, and have again driven the 70, east from Henrietta, towards Cartwright's, 5 fms. The water is coming out freely from this end, which leads us to think that we are approaching the lode. We have about 5 fms. further to drive, and get under the ore in the west of Cartwright's shaft. We are pushing on this end with a full pair of men with all speed to accomplish this important object. At Cartwright's shaft, sinking below the 48, the lode, which is from 2 to 3 ft. wide, is producing 2½ tons of copper ore per fm. The 48, east of Cartwright's shaft, has a lode 2 ft. wide, very kindly in appearance, worth 3 tons of ore per fathom. This we regard also as a very important feature in the mine, as we have none so far east in any of the upper levels. The lode in the bottom of the 34 is worth 3 tons of ore per fathom. The lode in the back of the 48 is also worth 3 tons of ore per fathom. The lode in the bottom of the 48 is worth 5 tons per fathom. We have 50 tons of good copper ore on the surface, which is the produce of one month's working at Cartwright's; but we have not been able to sell this ore to come to the credit of the account to-day, in consequence of the short time we have had to work on the ore ground since the mine has been drained. This ore will, however, be sold shortly, and we have no doubt with our present prospects that we shall at the next meeting of the shareholders be able to show a further credit for copper ore that will be satisfactory to them.

The CHAIRMAN said they were aware at their last meeting that an arrangement was entered into with the Henrietta Company for the use of their machinery. It took them a month to get the water out, and they had about another month to return ore from Cartwright's part of the mine. In that time they were disappointed at the slow progress which has been made, only 112 shares having been subscribed for at the close of the half-year. Although work had been resumed at the engine-shaft, the directors considered that they could not take upon themselves the responsibility of continuing the same unless more fully supported by the shareholders. Instructions were, therefore, given to cease working until the approval of the shareholders had again been ascertained. The directors cannot too earnestly press upon you the importance of subscribing this necessary capital; and, in order to re-open the subject, a special resolution for increasing the rate of the pre-ferred dividend payable upon the new shares from 8 per cent. per annum to 12 per cent. per annum will be submitted to the shareholders for their approval and sanction at once.

There has been an expenditure of 669. 14s. 6d. on capital account, less 339. 6s. 1d. realised by the sale of horses, carts, harness, &c.; and another loss of 1500. 17s. 2d. on the half-year's workings. When the directors were expecting to realise large sales of ore from the valuable portion of the mine known as the Junction shaft (at which in the 10 fm. level, which was reported at the last general meeting to be worth 50l. per fathom), the influx of water was such that the machinery then at work (a vortex turbine) was unable to cope with it; consequently, it became necessary either to increase the efficiency of the turbine, or provide a substitute. The latter course being considered the more economical and serviceable, it was decided—upon Capt. Hawke's recommendation—to erect a water wheel, 30 ft. in diameter, by 2 ft. 4 in. wide in the breast, in the interior of the mine, for the purpose of pumping and winding at the said shaft. This has now been done, and the shaft is again clear of water; and operations on the tribute pithead in the 10 and 20 fathom levels are resumed, but so recently that progress cannot yet be reported. During this suspension of operations at the Junction shaft, the inferior class of ore has formed the principal part of the small sales, which has caused a larger loss than would otherwise have occurred.

The CHAIRMAN agreed, saying he had received a letter from Wales on the previous day, speaking very hopefully of the market, and of the copper market in particular. East Seton was a nice little mine that could be worked inexpensively, and considering the present aspect of the market, together with their extremely good prospects, he had every reason to believe that ere long they would be in a much better position than they ever had been.

The agents' report was adopted, and the meeting thereupon terminated.

THE CALDBECK FELS CONSOLIDATED LEAD AND COPPER MINING COMPANY.

The half-yearly general meeting of shareholders was held at the offices, Carlisle, on Thursday.

The report of the directors stated that immediately after the last general meeting the directors took steps to carry into effect the resolutions then agreed to for raising the 5000l. new preference capital by the issue of 2500 new shares, but they are much disappointed at the slow progress which has been made, only 112 shares having been subscribed for at the close of the half-year. Although work had been resumed at the engine-shaft, the directors considered that they could not take upon themselves the responsibility of continuing the same unless more fully supported by the shareholders. Instructions were, therefore, given to cease working until the approval of the shareholders had again been ascertained. The directors cannot too earnestly press upon you the importance of subscribing this necessary capital; and, in order to re-open the subject, a special resolution for increasing the rate of the pre-ferred dividend payable upon the new shares from 8 per cent. per annum to 12 per cent. per annum will be submitted to the shareholders for their approval and sanction at once.

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THE COLLIERY INDUSTRIAL PARTNERSHIP SYSTEM.

The annual meeting of shareholders in Messrs. Henry Briggs, Son, and Co. (Limited), Whitwood and Methley Junction Collieries, was held at Whitwood Colliery, on Monday. There was a large attendance of shareholders.

Mr. H. CURRIER BRIGGS, Chairman of the company, presided.

The CHAIRMAN, in moving the adoption of the report, said they had gone on prosperously each year, and each year seemed to have added to their success, encouraging them in the belief that the system they first adopted when the company was formed had been the wisest one, and best promoted the true interest of the capitalist and workman.

During the past year they had made considerable additions to the property of the company, having purchased the Whitwood Main Colliery, the property of Messrs. Ellison and Broadbent, with a view of consolidating and establishing their position for the future. They had deemed it better to secure the coal nearest to their works, in order that they might the more readily extend their operations. The purchase of the Whitwood Main Colliery had been 55,000l., and out of the profits of last year's working they had already paid 30,000l. on account. They had also completed their arrangements for the extension of their operations in the Methley coal field, by the sinking of a pit they intended to call the Saville Pit, in honour of their landlord, Lord Mexborough, and adjoining the Midland Railway Company's line at Methley. They hoped during the coming year to carry the shaft down to the Haigh Main seam, which would largely increase their output in that portion of their property.

He paid a high compliment to the men who had hazarded their lives in putting down the new tubbing in the shaft of the colliery at Methley Junction, and said that but for the fact of their perseverance (they were shareholders) the work must otherwise have been abandoned. He urged the working shareholders and those who had participated in the bonus to husband their profits, and prepare for any day, as they could not expect to have always the same success.—Mr. MURRAY (Skipton), one of the directors, having seconded the resolution, the report was adopted, and a dividend declared at the rate of 17½ per cent. on the paid-up capital, amounting to 2s. 3d. 9d. per share, free of income tax.

Mr. ARCHIBALD BRIGGS, managing director, proposed that a bonus equal to 10 per cent. of the profits to the workmen of the company. The amount paid in wages this year had been 123,000l. against 83,000l. last year, showing that the amount paid in wages had been increased at the rate of 20 per cent., whilst the output of coal had been 18,000 tons less, or something like 4 per cent.—Mr. BERRY (Halifax) seconded the resolution, which was adopted.

Mr. G. V. ELLERTON (Wakefield) proposed a resolution confirming the purchase of the Whitwood Main Colliery at 55,000l., which was seconded by Mr. J. CHAPMAN (Wakefield), and adopted.

It was resolved to approve of gifts to the poor of Leeds and Bradford of 100 tons last winter.

Mr. J. S. BAILY, trade manager for the colliery, proposed, and Mr. JAS. PYRIE, a working shareholder, seconded, a resolution, which was adopted, proposing that 250l. be paid to the Yorkshire College of Science, in aid of the fund for establishing a professorship of mining engineering. It was stated that the Low Moor Company had promised to give 1000l. towards the object, on the condition that 500l. be raised for the purpose. Messrs. Charlesworth and the Sharlston Coal Company had also each given 250l.

In the evening another meeting was held, when Mr. J. S. BAILY occupied the chair. There was a large attendance of ladies and gentlemen and shareholders and workmen of the company. The object of the gathering was to present to Mr. Archibald Briggs, the managing director, a solid silver desert set, value, costing 250l. It consisted of a three-armed richly-chased centre piece, with four bowls, triangular plateau, two tall fruit-stands, designed as end pieces, with copper, fruit stands for side-pieces *en suite*, all engraved with arms, crest, initials, motto, and presentation inscription. The service was subscribed for by the officials, and workmen connected with the company. The presentation was made by Mr. Baily, who stated that whilst the subscriptions had been small they had been universal.

Mr. BURNLEY, as representing the surface workmen, and Mr. JOSEPH PYRIE, the underground workmen, added their testimony to the popular esteem in which Mr. Archibald Briggs was held by the workpeople at the colliery, and the readiness with which all had subscribed to the testimonial.

Mr. ARCHIBALD BRIGGS, in accepting the testimonial, said that during the eight years in which he had officiated, first as secretary, and then as managing director, of the company, its success had always been before him, and he was delighted that his labours had been so far crowned with success. He accepted the testimonial as an expression of their appreciation of the principles of industrial partnership, and of the way in which those principles had been worked out at their collieries. Alluding to the fact that Mr. Briggs's name had been associated with his in the pre-

Mr. R. RUCKER seconded the motion, which was shortly after unanimously carried.—On the motion of the CHAIRMAN, the distribution of profit, as recommended in the report, was, after considerable discussion, unanimously agreed to. On the motion of Mr. HUNTER, the following informal resolution was passed: "It is the opinion of the meeting that the difference between the vendors and the company should be settled by means of a friendly arbitration, if practicable." The proceedings closed with a vote of thanks to the Chairman.

that facilitated their getting morogoo down to the railway. Except as taken to the expenses of management and to the directors' fees, under 100*l.* for the Articles of Association. The allowance was 600*l.* for five, another 100*l.* for an additional one, should it be seen that it would be of advantage to the company to have six. The annual salary was 100*l.* a year. It was not to suppose that the company took over any cost with the directors. They did not take over any at all. A question was also asked as to travelling expenses. They were incurred in the visits of the directors to the collieries, and under the interests of the company there. The directors, to a certain

Mr. P. ALLEN moved a hearty vote of thanks to the Chairman, directors, and secretary (Mr. T. Jervis), which was carried *nem con.*, and the proceedings closed.

In addition to that they did not recover for some time after the colliery had been shut up their former output, nor could they expect to find the mines in the same condition—that was, immediately ready for resuming work—as they had been when daily kept in repair. Again, during the past year they had had to concede reductions in the wages of the workmen, amounting in the whole to about 20 per cent. Nor was that additional expenditure the whole measure of the distress that arose from a fall in the price of coal. The men, with advantage, wages the men naturally did not work quite so hard as they did when in receipt of less remuneration, consequently the amount of work done was considerably reduced.

A SHAREHOLDER drew attention to the fact that tin had been found in considerable

but he believed the price of this company's purchases compared favourably with those of that company.

able quantities near Brisbane, and suggested whether it would not answer this company's purpose to smelt it?
The CHAIRMAN said that it would require an extra furnace, but it was a question which was well worth consideration, and one which the directors would have no objection to take into consideration.
An unimportant discussion followed, and a DIRECTOR defended the board against a remark by a shareholder, that the business seemed rather a speculative one, and said the directors adopted the principle of selling in the best market, on the best possible terms, at the first opportunity. He drew attention to the fact that sales of the company during the past year had been above the average.
Mr. WILSON criticised one or two points of detail in the management, but said it was fair to state that their company had the reputation of selling copper at the best price in the trade.
A vote of thanks to the Chairman terminated the proceedings.

SOUTH WALES COLLIERY COMPANY.

An extraordinary general meeting was held at the London Tavern, on Thursday, Major LAWRENCE HEYWORTH in the chair.
The notice calling the meeting was read Mr. J. Mount F. Hunt, the secretary, and the directors' report, which was taken as read, was as follows:—
The directors in issuing their 19th half-yearly report, submit a statement of accounts for the six months ending June 28, 1873. The revenue accounts giving in detail the receipts and expenditure will be placed before the shareholders at the extraordinary general meeting on Aug. 28. The output of coal, as shown by the following statement, is not satisfactory, and can only be attributed to the disinclination of the men to work regularly.—Raised half-year ending June 29, 1872, 66,520 tons 12 cwt.; raised half-year ending June 28, 1873, 65,835; decrease 685 tons 12 cwt. The profit and loss account for the half-year shows a net profit upon the working of the colliery of 17,325/3s. 4d., which, with the sum of 1168/17s. 4d. carried forward from last half-year, shows a balance of profit and loss account of 18,494/0s. 8d., and the directors, after writing off 315/7s. 2d. in reduction of the outlay account, recommend the shareholders to sanction a dividend of 50s. (2/10s.) per share, free from income tax, payable on Sept. 10 next, which will absorb the sum of 14,531/15s. 8d. The directors further recommend that the sum of 2361/5s. 7d. be applied to the extension of "a suspense account," leaving a balance of 197/12s. 3d. to be carried forward to the next half-year. The sinking in the Ebbw Fach Valley has been stopped by water; the necessary pumps and temporary engine-power to work them are on the ground, and nearly ready to work; it is then anticipated that rapid progress will be made in sinking to the coal measures. Considerable outlay on capital has been incurred during the past six months—on the new pit, additional cottages, sanitary and surface improvements. A still further outlay will be required to develop your property to a profitable extent; to meet this expenditure the directors have made a call of 20s. per share, payable on Sept. 10 next. The underground workings, surface tramways, railroads, buildings, and machinery, have been kept in good repair, and considerable additions have been made to the railroad sidings on the surface during the past half-year. For detailed information as to the condition and ventilation of the underground workings, the shareholders' attention is directed to the reports of the viewer and colliery manager.

The CHAIRMAN: Gentlemen, this is purely a formal meeting; we have no quorum, and the recommendation of the directors is, as a matter of course, adopted—to declare a dividend. There can be no other business transacted. I think the report explains itself. If you have any questions to ask, Mr. Bowyer, I shall be happy to answer you.

Mr. BOWYER: How long will it be before you sink the new pit?—The CHAIRMAN: I cannot exactly say; I should think a year.

Mr. BOWYER: How much more will require to be expended until further than the sum expended hitherto?

The CHAIRMAN: Do you mean on the whole colliery or on the pit?—Mr. BOWYER: On the pit, house, and property.

The CHAIRMAN: Well, I estimate about 17,000/ more, but it is my own private estimate.

Mr. BOWYER: Then it will cost something like 30,000/.—The CHAIRMAN: What it has cost will have to be added, of course, to the 17,000/. We shall have to make another call next half-year of 10/ or, perhaps, of 20s.; I fully expect 30s.

Mr. BOWYER: I suppose you will maintain your dividend?—The CHAIRMAN: Yes, I think we shall maintain our dividend.

On the motion of the CHAIRMAN, seconded by Mr. BOWYER, a dividend of 20/ 10s. for the half-year was then declared.

It may be mentioned that this dividend is subject to the deduction of 1/ 6d. per share on account of a call, which is made payable on the same day as the dividend.

Mr. LAWRENCE said there one observation he had to make, which would, no doubt, be gratifying to the shareholders. He that morning had the pleasure of meeting Mr. Rowcliffe, one of the shareholders, who said he had well considered the question of the Crown Hill, in which he had taken a great interest, and he had come to the conclusion that it would be a good thing to support, and had authorised his name to be put down for 25s., as representing the Browne property, and would give 5/ himself, and another gentleman was also prepared to put his name down for 5/.

The CHAIRMAN said he was exceedingly pleased to hear this, as he considered that the property referred to would be an important feature in the colony. He hoped the other 50 shareholders would also subscribe to it.

The meeting then broke up.

GOLD MINING COMPANY OF YUBA.

A general meeting of shareholders was held at the office, Finch-lane, on Wednesday, Mr. ORMEROD in the chair.

Mr. STEVENS (secretary) read the notice convening the meeting.

The report of the directors was read, as follows:—

The directors regret that, in consequence of the want of funds absolutely necessary for the proper development of the company's property, they are unable on the present occasion to congratulate the shareholders on having actually realised those hopes of success which were confidently entertained last year. At the extraordinary general meeting, held in February last, the exact position of the company was fully explained, and an estimate was submitted of the amount of further capital required to free the undertaking from debt, and enable the manager to put through the mill 150 tons of ore per month. Amongst the several items of expenditure included in this estimate was \$2000 (say, £400), for driving a tunnel which had been already commenced, and 1000/ for erecting a furnace; and other charges were estimated, swelling the total amount of capital required up to May 31 last (when it was hoped the returns would begin to come in) to \$4000, exclusive of the expenses of the London office. Under these circumstances, as the shareholders will recollect, the directors were authorised to invite applications for debentures to the amount of \$6000, and they believe that if two thirds, or even one-half, of that amount had been promptly subscribed the position of the company at the present time would have corresponded with the expectations which were held out to the meeting. Unfortunately the response from the shareholders has been altogether inadequate to meet the emergency, and the consequence has been that while every letter received from the mine confirms the substantial accuracy of the estimate formed of the value of their property, the whole of it is in danger of being sacrificed for the want of 3000/ to pay the pressing creditors of the mine, and re-start the mill. Having regard to the disappointment which the shareholders have experienced in the non-payment of dividends, the directors are not surprised that there should be some backwardness in subscribing further capital, but they feel the imperative necessity of doing so cannot be too strongly urged, as the very existence of the company is at stake. The amount of debentures actually subscribed for up to the date of balancing the accounts, was \$600. The directors, relying upon Mr. Mattingly's statements, believe that a further sum of \$600, or 600/ expended on the mines will bring them into a paying condition; but that if this additional amount is not provided there is great reason to apprehend that the capital already invested will be lost.

Kidron, Utah, Aug. 3.—Not having received any advice from you up to the 15th ult., I left the mine to come out to this place in order to meet Dr. Bishop and confer with him relative to the affairs and business of the company, as well also as to attend to some other matters of freight and supplies heretofore forwarded, but delayed on the way, and also to try and make arrangements with some parties for moneyed assistance in furthering our work, &c. Since my arrival here I received your cable despatch of the 17th ult., and also advice from the London and San Francisco Bank of a remittance of \$1450, which will relieve present necessities very much, and I will make it go as far as possible towards starting the mill into operation, as well as other work necessary. I only regret that the amount is not greater and more sufficient to relieve all indebtedness, and have one or two months working capital ahead, which from indications and present developments in sight would certainly give us success equal to anticipations heretofore expected. I left the work in charge of Dr. Marshall during my absence; he has two men at work in the Stanley, at a point heretofore indicated in my former letters, and is taking out ore of high grade, and from its appearance will be easily treated and worked. We may make a run on this before starting on Leonora ore, as some two weeks time will be required to build a road from the tunnel to the old road near the mill. When I receive your letters and advice I will be able, I hope, to form some more definite course of action than at present presents itself to my mind. However, I shall try to save off and put off, for a time, any rate, as much of the indebtedness as I can, and with this money, or a part of it, start operations, even though in a small way, as it must be, and try to get out money to pay, &c. for it is certainly clear that if we were only in active working operation we would take out more money every week than twice or thrice all our indebtedness. I have had much talk with Dr. Bishop, who will write you at length, I suppose. I will now return to the mine as soon as possible, from whence I will write you fully.—S. MATTINGLY.

The CHAIRMAN had not much to add to the facts communicated in the report just submitted. The shareholders were fully acquainted with the difficulties of the company's situation, which had arisen entirely from want of the necessary funds. Letter after letter from Mr. Mattingly expressed his great regret at the absence of the necessary capital for developing the mines, adding from time to time that his best hopes had been realised as to the productiveness and value of the property, everything encouraging him to believe that all the promise he had held out would be substantially verified; but he says he cannot go on without capital. The directors had made themselves personally liable for 3000/ and 2000/ which amounts had been sent out to Mr. Mattingly to meet the claims of pressing creditors, but further capital was wanted to send out, for it was idle to hope that Mr. Mattingly could make the mines productive by merely paying off pressing creditors; one or two months working capital must be provided, for they could calculate upon bullion before that period—to put them in a comfortable and safe position they should have 1000/. Mr. Mattingly had received 5000/ out of the 2000/ indebtedness. He wished to impress upon the shareholders the absolute necessity, now the mine had proved all that had been anticipated, to come forward and co-operate with the directors in providing the small amount of capital requisite to reap the full benefit of all their previous outlay. He added that the last letter received from Mr. Mattingly was the most satisfactory one ever yet received, stating, as it did, "that if the mine were in active operation he could take out more money in one week than twice or thrice the indebtedness of the company." Taking it at twice only, it represented 50,000/ per annum. He repeated that he hoped the shareholders would provide the necessary means, for if they did so there seemed every probability that when they next met they would be able to state that something more than encouraging promises had been realised. He then moved that the report and balance-sheet be received and adopted.

Mr. GRIFFITH seconded the proposition.
The CHAIRMAN, referring to the item in the balance-sheet due to the directors as fees, stated that he could promise for his colleagues that they would accept in lieu of payment either shares or debentures.
The report and accounts were received and adopted unanimously.
Mr. Ormerod and Colonel Wemyss were re-elected directors.
A vote of thanks to the Chairman and directors closed the proceedings.

MELLANEAR MINING COMPANY.

An extraordinary general meeting of shareholders was held at the offices, Bartholomew House, Bartholomew-lane, on Thursday, to consider the advisability of suspending the sales of copper ore, in consequence of the present low prices, and raising further capital to carry on the operations at the mine until the sales of ore be resumed; also, if approved, to pass the following resolution:—

"That the borrowing powers of the directors be increased to 10,000/ by the alteration of Article 15 in the company's Articles of Association, as follows:—The directors may from time to time, as in their judgment they may deem expedient, borrow, on the security of mortgage debentures, without any further authority than a resolution of the board, any sum or sums of money for the purposes of the company, and at such rate of interest as they may deem expedient, but that the sums so raised shall not in the aggregate exceed 10,000/ at any one time; the rest of the Article remaining unaltered."

Mr. WILLIAM NEWLAND RIDGE in the chair.

Mr. H. WILSON (secretary) read the notice convening the meeting.

The following report was then read:—
Aug. 27.—No material change has taken place in the character of the ground in Gundry's shaft or on the branch in the 60 cross-cut worthy of notice since our report of last week. Since we suspended operations in the old mine the water has risen up to 5 fms. above the 50 fm. level, but now rising very slowly, which has caused an increase at Gundry's shaft from 1 1/2 stroke to 3 strokes per minute. This we reasonably expect; and as the 50 fm. level in the old mine is about the same level as the 60 cross-cut is at Gundry's, it may rise but very little higher. We have sampled computed 316 tons of ore ready for the next sale, to be held on Sept. 4—200 tons is from 6 1/2 to 7 per cent. for copper; the remainder is of a lower grade.

The CHAIRMAN said that while the returns were quite equal to their anticipations, and could be easily increased, having been in July 400 and in August 354 tons, the commercial value of the produce had, unfortunately, so considerably fallen off in value, that instead of realising 4/ 9s. per ton, as they were in September last, it now fetched only 2/ per ton. As at these prices they could not realise a profit, it was thought better to cease raising ore until improved prices ruled, and in the meantime continue the sinking of Gundry's shaft, which would eventually enable them to work the mine at a considerably lessened cost. He need hardly say that the directors, who were by far the larger shareholders, were equally disappointed with the other proprietors.

The SECRETARY read a letter from the purser, stating that the copper standard was likely to improve, and expressed a hope that a fair price would be obtained for the 300 tons to be sold on September 4.

After some discussion, the policy of the board in suspending the sales of copper ore was generally approved.

Mr. HUSKIN (Harvey and Co.) in reply to a question, stated that it would probably cost about 4000/ or 5000/ to sink the mine. Mr. THOMAS had understood that the engine at Gundry's shaft was sufficient to keep the water.

The CHAIRMAN said it did keep the water to the 50 fm. level. As he had already stated, it was proposed to continue the sinking of that shaft.

Mr. W. GUNDY (a director) explained that when the shaft had been completed the ore would be raised much more cheaply.

Mr. THOMAS had always understood that the reserves were of the value of something like 30,000/ or 40,000/.

The CHAIRMAN said Capt. Rogers valued the reserves at that amount, but at that time copper ore was worth 4/ per ton.

Mr. W. GUNDY said there could be no doubt as to the quantity of copper, for the bottom level the 50 had been driven 30 fms. in a good lode, and the end was rich, and the 70 also.

Mr. HUSKIN said his firm was among those who had recommended the present course.—Mr. W. GUNDY said that although the mine could not now be worked without loss, yet by-and-by it would no doubt be worked at a good profit.

Reserves would now be taken away at a loss, whereas by-and-by they would yield large profits.

The CHAIRMAN said there was a liability of 4000/, and the directors proposed to increase the borrowing power to 10,000/. He hoped the shareholders would come forward and co-operate with the directors, because there was no doubt they possessed a very valuable mine, and it was necessary to pay off the liabilities and provide working capital for some months, by which time Gundry's shaft would sink to the required depth.

The CHAIRMAN proposed the resolution embodied in the notice convening the meeting, which was seconded by Mr. BURNARD, and carried unanimously.

A vote of thanks to the Chairman and directors closed the proceedings.
(For remainder of Meetings see to-day's Journal.)

FOREIGN MINING AND METALLURGY.

Transactions in the Belgian coal trade have not presented much interest, and the state of affairs has undergone no material change. A contract now on hand for coal for the Belgian State Railways will indicate more clearly the position of affairs. The struggle between buyers and producers will probably become more decided, but every day the chances of success are increasing for the former, as the arrivals of coal from England and Germany present a good deal of activity.

An opinion seems to be gaining ground in the Liège basin that a decline in prices would be general and well established if a large number of workpeople now employed in country work had not by their absence diminished the daily production. On the return of these workmen, it will become very difficult to maintain quotations at their present point. Coke has continued to fall, and has been dealt in currently at 17/ 12s. per ton, but at this rate the profit must be very small with coal at its present official price. There has been nothing very interesting to report in connection with the French coal trade; English and German coal has continued to flow in more and more freely. It is stated that the delivery of more than 100,000 tons of English coal upon the French markets has been contracted for, and that at prices which must bring about a reduction upon the French and Belgian markets. Meanwhile, however, the colliery proprietors of the French departments of the Nord and the Pas-de-Calais maintain quotations at the highest possible point. The Mearchin Colliery Company has announced a dividend for 1872-3 at the rate of 4/ per share.

There have been scarcely any important transactions in copper during the last few days. Chilean in bars has made 80/; ditto in ingots, 88/ 4s.; and Corocoro minerals, pure standard, 80/ per ton. In Germany the copper markets remain in much the same state; transactions are restricted, and speculators hold aloof. There have been few transactions in tin at Paris, and prices have been almost nominal; Banca, delivered at Havre or Paris, has made 144/; ditto Straits, 150/; and English, delivered at Havre or Rouen, 146/ per ton. At Rotterdam tin has been quiet, and although stocks must be said to be comparatively small, holders have pressed sales; Banca has been quoted at 78 1/2 fls., and Billiton at 77 fls. There has been no great amount of business passing in tin in Germany. French, Belgian, and German lead have been quoted at Paris at 25/ 12s. per ton, and Spanish at 22/ 16s. per ton, with delivery at Havre. The German lead markets have remained without any very great variation. There has been no change in the Paris zinc market, and the German zinc markets call for little comment.

The French iron trade has not revived from the torpor in which it has so long languished. There is no animation in affairs, and comparatively little business is passing, while prices are stationary. It would be difficult for industrials to go lower unless they worked at a loss. Machine iron alone forms an exception to the general inactivity; several transactions have been concluded at 14/ to 14 1/2 8s. per ton for mixed qualities. Pig is neglected, and prices are purely nominal. Charcoal-made pig for refining is quoted at 62/ 16s. to 71/ per ton; mixed pig for refining (half-coke), 62/ 4s. to 71/; coke-made pig for refining, 4/ 16s. to 5/; coke-made pig for second fusion, No. 1, 7/ 8s. to 7/ 12s.; ditto, No. 3, 6/ 12s. to 6/ 16s.; first-class rolled iron coke-made, 11/ 4s. to 11/ 16s.; mixed rolled iron, 12/ 8s. to 12/ 12s.; and charcoal-made rolled iron, 12/ 16s. to 13/ 4s. per ton. Rough axes have been quoted 13/ 16s. to 14/ per ton; and finished axes, 18/ 8s. to 18/ 16s. per ton. In the first half of this year there were in activity in the Haute-Marne group 70 blast-furnaces, 22 being worked with charcoal, 10 with coke, and 38 with mixed mineral and vegetable combustible. The group had also 12 rolling-mills. The metallurgical production of the Haute-Marne during 1872 is estimated as follows:—Rough pig for refining, 740 tons; cast-pig, first fusion, 9230 tons; cast-pig, second fusion, 10,000 tons; rolled iron, 7208 tons; and hammered iron, 8000 tons. The intelligence received as to the Paris iron market is not favourable; a slight fall has occurred in rolled iron; No. 2, first-class, is maintained between 12/ 8s. and 12/ 16s. per ton, with a scale of 16s. per ton between each class. Special descriptions of iron have also been dealt in at a fall. There has also been rather a decided downward move-

ment in cast-iron. Old iron has been supported with some firmness at between 7/ 4s. and 7/ 12s. per ton, but there has been no great amount of business passing in it. MM. Michel Helsen and Co., of Hautmont, in the department of the Nord, have decided on establishing a second blast-furnace and a rolling-mill for the production of plates and other special iron. The capital of the concern is to be carried to 72,000/., and this amount has been fully subscribed. M. J. B. Helsen has been appointed director of the works.

The principal event of the last few days in Belgium has undoubtedly been the visit to Liège of the Iron and Steel Institute of Great Britain, which has passed off in the most cordial and satisfactory manner. Iron has been quoted at 11/ 4s. per ton upon the Belgian markets, but it is badly supported upon those terms; the concessions made have been concealed by variations in the scale between numbers. Pig has been heavy at former prices; there appear, however, to be some hopes of a revival—not in prices, but in orders. The Couillet Company have blown out one of their furnaces. On the other hand, it is hoped that some rolling mills which had stopped will be again set to work. Some orders have been received for railway plant. One or two contracts for such plant have been concluded, and some makers have their order books filled for a year in advance, but all are, unfortunately, not so well off, and it is this circumstance which induces apprehensions that the resumption of working operations at the rolling-mills may, after all, prove only temporary. A fall in coal is regarded as inevitable, and altogether, if the present is charged with clouds, there are, at any rate, some blue specks upon the horizon. The Belgian Company for the Construction of Machinery and Railway Plant has been officially authorised to add a number of new appliances to its works at La Louvière. Certain concessions provisionally granted to forgers in the Grand Duchy of Luxembourg have been approved by a Bill just sanctioned by the Grand Ducal Legislature. The Acor Forges Company will pay Sept. 1 a dividend of 2/ per share for 1872-3.

The production of the Royal Sarrebruck Coal Mines in the first half of this year amounted to 2,057,205 tons, against 1,983,592 tons in the corresponding period of 1872. Of this quantity there were dispatched in the first half of this year 1,244,059 tons by railway, and 257,101 tons by water; in the first half of 1872 the corresponding movement was 1,087,525 tons by railway, and 330,940 tons by water. The deliveries made by railway took the following directions in the first half of this year:—354,370 tons into the interior of Germany, 220,072 tons into the Palatinate and Hesse, 236,346 tons into South Germany, 235,458 tons into Alsace and Lorraine, 13,750 tons into the Luxembourg, 95,160 tons to France, and 87,866 tons to Switzerland and the Tyrol. Coke-producing works consumed in the first half of this year 238,335 tons of Sarrebruck coal, against 193,163 tons in the corresponding period of 1872. The production of July amounted to 286,090 tons, and according to all appearances the production of August will exceed that of July. The direction of the Royal Sarrebruck Mines proposes to increase its tariff in consequence of the generally firm tone of the coal trade.

GOLD IN PRUSSIA.—It is said that auriferous sand has been found in Rhinisch Prussia, near Tullin. The *Frankfurter Zeitung* infers from the attention given to the matter by the Prussian mining authorities that the value cannot be small. A company of capitalists has been formed to work the diggings, and has formally applied to Government for a mining licence.

LAST CHANCE SILVER MINING COMPANY OF UTAH.—The directors have issued the following circular:—I am directed to inform you that the board of the letters and accounts received this month from the shareholders at not receiving a circular announcing a dividend for this month, but upon reference to the report furnished to the shareholders at the general meeting held in February 1873, it will be observed that a contract for sales of ore for forward delivery had been made to provide for the payment of dividends during the erection of furnaces. The directors were pleased to be able on the 13th, and also on the 23rd, inst. to be able to publish runs from the completed furnaces, therefore, the contract referred to being terminated, they now await accounts and remittances from the manager to guide them in payment of the next dividend. Capt. Forbes and Mr. Maxwell strongly recommend quarterly dividends in future, and the directors also are of opinion of the propriety of taking this course. The prospects of the mine continue to be of the most satisfactory character.

THE FLAGSTAFF SILVER MINING COMPANY OF UTAH.—The directors have issued the following circular:—The directors, after full consideration of the letters and accounts received this month from the shareholders, have come to the conclusion that the further payment of monthly dividends is inconsistent with the interests of the company, and that it is better to expose the proprietors to a temporary disappointment, rather than to embarrass the future of their valuable property. There are two leading principles that guide the directors in carrying out this decision, viz.—1. The business in Utah must be placed strictly on a cash basis. The balance-sheet of Nov. 30 presented to the general meeting showed a floating debt of 10,000/; on May 31 this amount appears, from accounts since received, to have risen to nearly 30,000/., owing to the interruption of hauling in the winter. Since that date a reduction has been made to 14,000/., besides providing large sums for the re-building of furnaces, &c. This debt must be extinguished, and the manager must hold sufficient money for the future to pay engagements as they arise. 2. The manager must also be freed from the obligation and embarrassment of providing for dividends at such short intervals, and thus be able to attend to his various duties—viz., the yield and development of the mine, transport, smelting, purchase of materials, &c., with exclusive regard to produce and cost, and the realisation of ore and bullion to the best advantage. These points have been fully discussed in the correspondence of Capt. Forbes, R.N., and Mr. Maxwell with the board. In his latter letters, as Capt. Forbes has become familiar with the various parts of the management, while he expresses unshaken confidence in the value and prospect of the mine, he insists upon the necessity of its being worked without the least strain of monthly dividends, as the only way of enabling the shareholders to reap the full benefit of their property, in which view Mr. Maxwell entirely concurs. Capt. Forbes is also adverse to further sales of ore being made for onward delivery until present contracts are completed. The coming winter will be devoted to the opening up of the mine, by which room will be made for additional hands, and the output of the following season admit of a corresponding increase. The directors propose for the future to distribute the revenue received from the mine in quarterly dividends, setting aside some portion for a reserve fund. Plans and accounts of the mine, with explanatory references, prepared by Mr. Maxwell, are now in the way, and will be printed as soon as received and circulated amongst shareholders.

COPPER ORES.

Sampled Aug. 6, and sold at the Royal Hotel, Truro, Aug. 21.

Mines.	Tons.	Price.	Mines.	Tons.	Price.
Devon Great Consols.	108	4 14 6	South Caradon	52	4 12 6
ditto	91	4 14 6	ditto	47	4 15 0
ditto	85	3 12 6	Glasgow Caradon	30	5 0 6
ditto	72	3 6 6	ditto	70	3 14 6
ditto	85	2 1 6	ditto	68	5 0 6
ditto	59	5 5 6	ditto	61	4 7 6
ditto	42	5 2 6	ditto	37	3 13 0
ditto	31	3 11 0	East Caradon	82	5 19 0
ditto	19	1 11 0	ditto	72	5 1 6
ditto	5	24 15 0	ditto	62	5 14 6
ditto	4	21 16 0	ditto	42	3 5 6
Marke Valley	82	3 5 0	Hing the Down	54	3 3 6
ditto	61	2 15 0	ditto	45	2 19 0
ditto	50	6 17 0	Prince of Wales	84	4 6 6
ditto	45	3 4 6	ditto	67	4 1 6
ditto	44	1 2 6	Phoenix	58	5 12 6
ditto	41	3 9 6	ditto	54	2 17 6
South Caradon	85	9 6 6	Wheel Russell	35	5 12 0
ditto	80	8 7 6	ditto	33	3 7 6
ditto	75	8 6 6	Crabtree Moor		
ditto	71	4 14 6			

TOTAL PRODUCE.

Devon Great Con.	592	£2502 9 6	Hington Down	161	605 8 6
Marke Valley	421	1435 13 6	Prince of Wales	151	608 6 6
South Caradon	410	3153 14 6	Phoenix	112	705 7 6
Glasgow Caradon	319	1498 17 6	Wheel Russell	112	184 12 6
East Caradon	240	1239 5 0	Crabtree Moor	33	111 7 6

Average standard £ 97 1 0 / Average produce 75
Average price per ton £4 15 6
Quantity of ore 2186 / Quantity of fine copper 192 tons 15 cwt.
Amount of money £11,872 14 0

LAST SALE.—Average standard £ 92 3 0 / Average produce 75
Standard of corresponding sale last month, £ 94 7 0 / Produce, 69 1/2

COMPANIES BY WHOM THE ORES WERE PURCHASED.

Names.	Tons.	Amount.
Vivian and Sons	111	£ 351 3 6
Grenfell and Sons	111	1562 8 6
Neill, Drury, and Co.	405 1/2	1992 7 9
Williams, Foster, and Co.	1964 3/4	4861 15 3
Mason and Elkington	286	1407 2 0
Copper Miners' Company	80	402 0 0
Sweetland, Tuttle, and Co.	285	1315 17 0
Total	2480 1/2	£11,872 14 0

NO SALE on Thursday last, August 28.

Copper Ores for sale on Thursday week, at Tabb's Hotel, Redruth.—Mines and parcels.—Mellanear 201—West Seton 250—East Pool 200—North Croft 180—Boscarnell 45—West Basset 35—Trebahar 32—Levant 32—North Croft 24—Richard's Ore 22—Providence 10—Poldice 7—Poldrean 6—Trenavean 5.—Total, 1161 tons.

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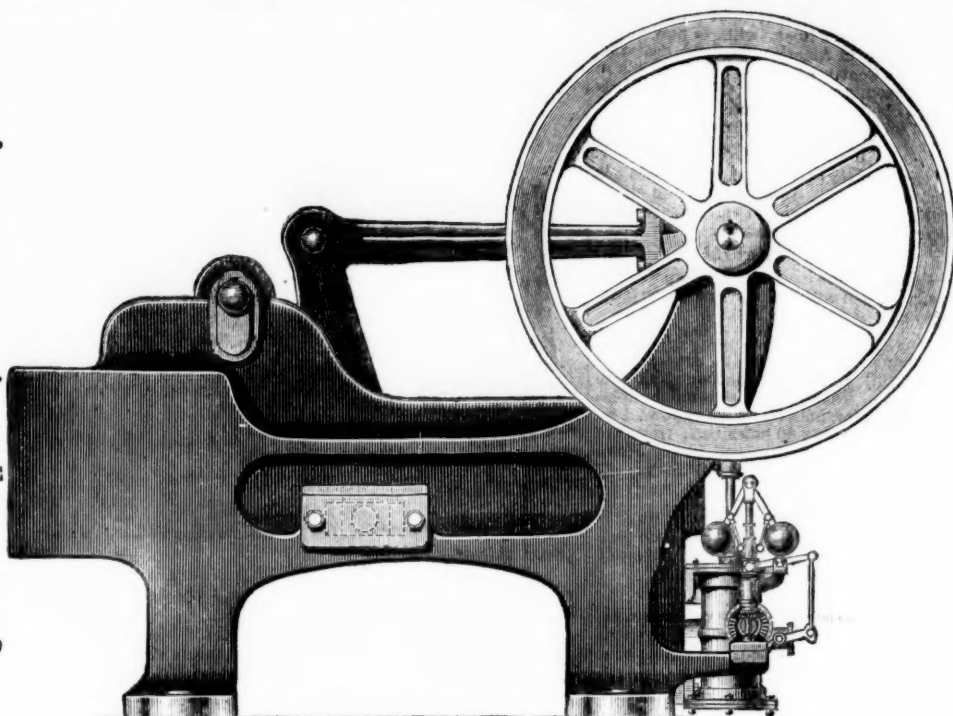
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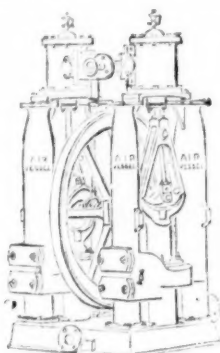
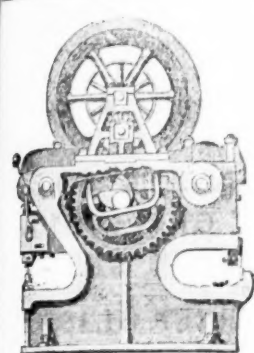
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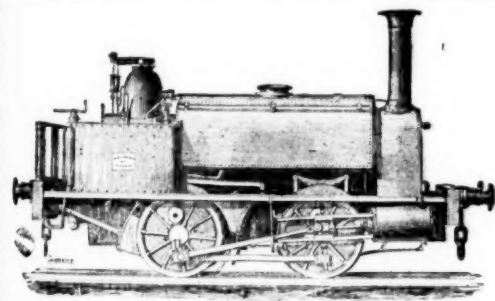
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CAST STEEL PISTON RODS, CRANK PINS, CON
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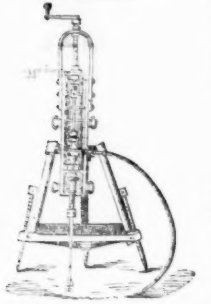
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THE "BURLEIGH" ROCK-DRILLING MACHINERY.

THOMAS BROWN,
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THE "BURLEIGH" ROCK DRILL.



Machine and Stand for Quarrying and Sinking.

This celebrated ROCK DRILL, which by reason of its inherent merits has superseded all other Rock Drills, is now in extensive use in America, England, Scotland, and the Continent, and is indispensable in the economic working of all Railway Cuttings, Shafts, Quarries, and Mines.

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Any labourer can work it, and it does not get out of order. It may be worked either by air or steam power, at will, without any alteration of the mechanism.

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No part of the mechanism is exposed; it is all enclosed within the cylinder—so there is no risk of its being broken.

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In hard rock, like granite, gneiss, ironstone, quartz, the Tunnel Drill will progress at the incredible rate of 6 inches to 12 inches per minute. These machines can bore holes from 1 inch up to 5 inches in diameter, and, on an average, will go through 120 feet of rock per day—making 40 holes each from 2 to 3 feet deep. The drill can be used at any angle, and in any direction, and will drill and clear itself to any depth up to 20 feet.

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As compared with hand labour the saving in actual drilling is very considerable, from the fact of the "out put" being increased fourfold. The saving in the general expenses, and in the interest of capital, will be in a like ratio.

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The saving in steel alone is incredible, ONE DRILL POINT WILL GO THROUGH TWENTY FEET OF ABERDEEN GRANITE WITHOUT SHARPENING. This fact will be duly appreciated by practical men.

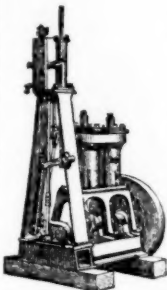
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AIR COMPRESSOR,
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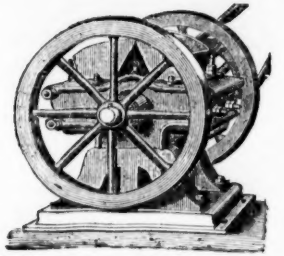
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Machine No. 1—The Direct Double-Action.

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PATENT STONE BREAKING, QUARTZ CRUSHING, AND GRINDING MACHINERY.

Messrs. T. BROWN and Co., ENGINEERS, have much pleasure in calling attention to their IMPROVED MACHINERY for STONE BREAKING and QUARTZ CRUSHING, for crushing, grinding, triturating Stone, Flint, Minerals, Ores, Chemicals, and other substances; for washing and separating Metals from Ores, and for extracting Gold from Quartz.

The principle of this invention is applied to machines of various construction, which contain within the range of their capability the power of reducing all hard materials to cubes of from 2 1/2 inches to impalpable powder. The mechanical construction of each description of machine is specially adapted for its own peculiar work, and experience has shown that each is eminently suited for the work which it is designed.

They can be driven by water, steam, or horse power; they are light and portable, and their crushing and grinding surfaces are constructed that when worn they can easily be replaced.

If intending purchasers would send a sample of the materials required to be crushed or broken it could be operated upon in the presence, and thus they would be guided in the selection of the machine best suited for their requirements.

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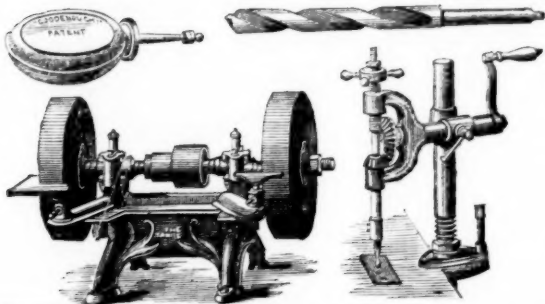
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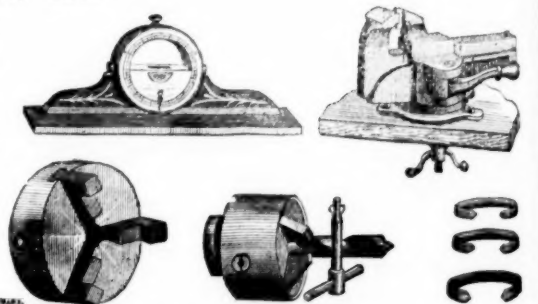


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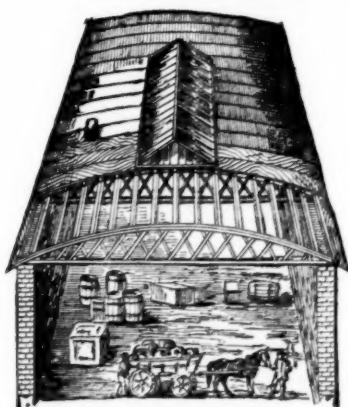
Morse's Twist Drill, and Machine Company's celebrated Twist Drills and Chucks; American Scroll Chucks; Stephens' Patent Vices; Parker's Patent Parallel and Swivel Vices; Gould Manufacturing Company's Well and Cistern Pumps; Washita, Arkansas, and Hindostan Oil Stones; and all other descriptions of American Tools and Machinery &c., &c.

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FOR
GREAT ECONOMY
AND
CLEAR WIDE SPACE.

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CORPORATION STREET, BELFAST.

The above drawing shows the construction of this cheap and handsome roof, now much used for covering factories, stores, sheds, farm buildings, &c., the principal of which are double bow and string girders of best pine timber, sheathed with 1/2 in. boards, supported on the girders by purlins running longitudinally, the whole being covered with patent waterproof roofing felt. These roofs so combine lightness with strength that they can be constructed up to 100 ft. span without centre supports, thus not only affording a clear wide space, but effecting a great saving both in the cost of roof and uprights.

They can be made with or without top lights, ventilators, &c. Felt roofs of any description executed in accordance with plans. Prices for plain roofs from 30s. to 60s. per square, according to span, size, and situation.

Manufacturers of PATENT FELTED SHEATHING, for covering ships' bottoms under copper or zinc.

INODOROUS FELT for lining damp walls and under floor cloths.

DRY HAIR FELT, for deadening sound and for covering steam pipes, thereby saving 25 per cent. in fuel by preventing the radiation of heat.

PATENT ASPHALT ROOFING FELT, price 1d. per square foot.

Wholesale buyers and exporters allowed liberal discounts.

PATENT ROOFING VARNISH, in boxes from 3 gallons to any quantity required 6d. per gallon.

THE
"MEDAL OF PROGRESS"

(HIGHEST AWARD FOR STEAM PUMPS)

HAS BEEN GRANTED

FOR THE

**"UNIVERSAL"
STEAM PUMP,**

BY THE

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FOR 1873.**

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CHARLES BALL AND CO., lately Sole Agents for
THE BURLEIGH ROCK DRILL,

ARE NOW PREPARED TO SUPPLY THEIR NEW

ROCK-BORING MACHINE, OR "POWER JUMPER,"

Which they consider far superior to any other Rock-boring Machinery existing, and which they have, therefore, undertaken to bring before the public. The Firm's principle

"INVENTORS OF NONE—AGENTS FOR THE BEST"

Secures to its customers the best known machinery, as the Firm is entirely impartial in its adoption of any particular style of machines.

THE "POWER JUMPER"

Is recommended to the public on account of its qualities, which are the following. It is—

CHEAPER,
SIMPLER,
LIGHTER,
SHORTER,
THAN ANY OTHER.
COMPARISON INVITED.

Secondhand
BURLEIGH DRILLS
FOR SALE.

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SOLE AGENTS FOR "S. B. HEMATITE,"
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BAR IRON, STEEL, SPALTER, TIN, COPPER, LEAD, SHEETS, ORES,
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By a special method of preparation, this leather is made solid, perfectly close in
texture, and impermeable to water; it has, therefore, all the qualifications essen-
tial to pump buckets, and is the most durable material of which they can be made.
It may be had of all dealers in leather, and of—

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for HUMAN BEINGS; ditto, for Animals; price 1s. each.

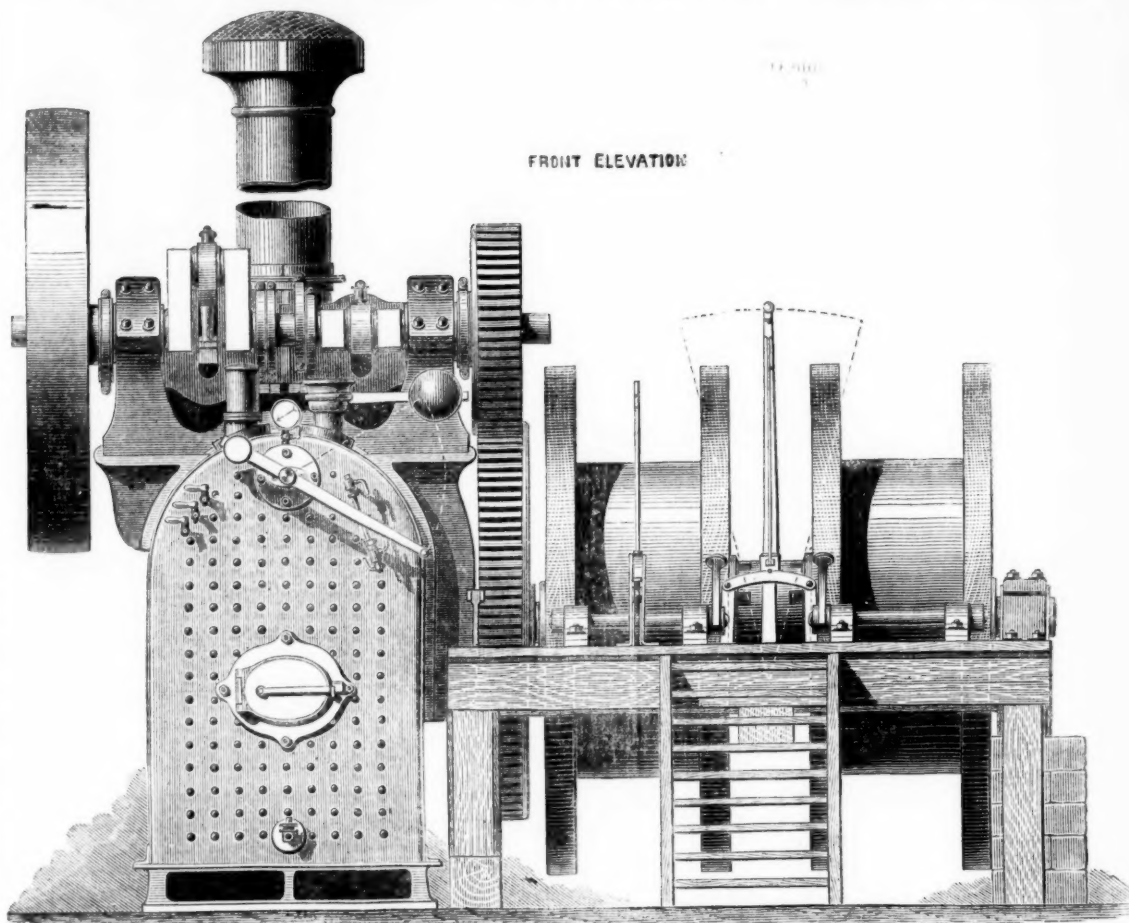
Publishers: SIMPKIN, MARSHALL, and Co., London; JOHN HEYWOOD, Man-

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FROM 20 TO 200 EFFECTIVE HORSE-POWER.

FOR FULL PARTICULARS AND PRICES, APPLY TO—

ROBEY AND COMPANY, LIMITED,
PERSEVERANCE IRONWORKS, LINCOLN.

ALSO OF PATENT PORTABLE

HAULING & WINDING ENGINE

WITH

PATENT DRUM WINDLASSES,

FOR MINING PURPOSES.

This Engine is specially commended to Mining Engineers and others, as by its adoption—

Haulage along inclined drifts is easily and cheaply effected;

The expense of sinking new shafts is greatly reduced, neither foundations nor engine-house being required

It is available not only for winding, but for pumping, sawing, &c.—a great desideratum at a large colliery;

It can be very quickly removed (being self-propelling), and fixed in any desired position.

Prices and full particulars on application as above, and also references to view the engine in successful work near Derby, Carnarvon,

Haverfordwest, Darlington, Durham, Penzance, and other places.

THESE ENGINES WORK WITH MARVELLOUS ECONOMY IN FUEL.

CHAS. PRICE AND CO.'S RANGOON ENGINE OIL,

AS SUPPLIED TO H.M. DOCKYARDS AND FLEET.



THIS OIL is suitable to every kind of Machinery. As a lubricant it is equal to the best Spermin or
Lard Oil, while it possesses the great advantage of being entirely free from any principle which will
corrode the metal bearings.

For particular kinds of Machinery, the Oil may be specially prepared of a consistency and character
adapted to the nature of the work to be done.

"Chemical Laboratory, 7, Printing House-square, Blackfriars, April, 1869.

"I herewith certify that the Rangoon Engine Oil, manufactured by Messrs. Chas. Price and Co., is
free from any material which can produce corrosion of the metal work of machinery. It is indeed
calculated to protect metallic surfaces from oxidation.

"The lubricating power of this oil is equal to Spermin or Lard Oil.

"T. W. KEATES, F.C.S., &c., &c.

Every parcel of the Oil sent from the work bears the Trade Mark of the Firm.

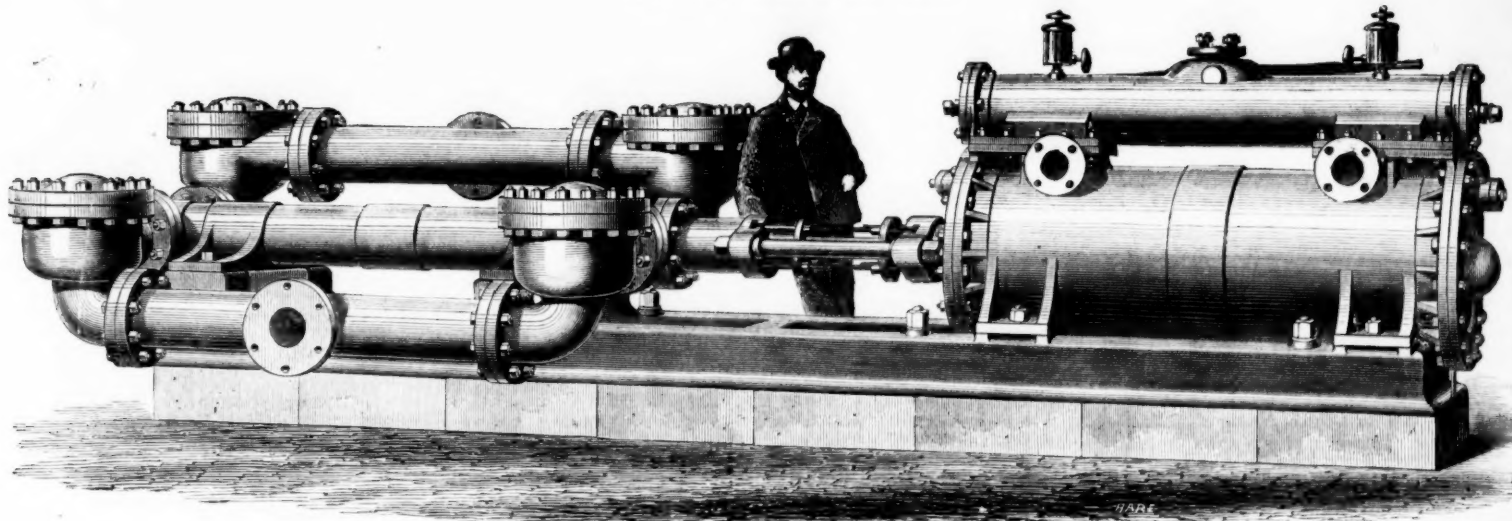
LONDON: CASTLE BAYNARD, UPPER THAMES STREET.

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TANGYE BROTHERS AND HOLMAN,
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NEWCASTLE-ON-TYNE (TANGYE BROTHERS AND RAKE), OFFICES AND WAREHOUSE, ST. NICHOLAS' BUILDINGS;
SOLE MAKERS OF

THE "SPECIAL" DIRECT-ACTING STEAM PUMPING ENGINES
FOR FORCING WATER FROM MINES.
Nearly 3000 in Use.



The "SPECIAL" Direct-acting Steam Pumping Engines require no costly Engine Houses or massive foundations, no repetition of Plunger Lifts, ponderous Connecting-rods, or complication of Pitwork, and allow a clear shaft for hauling purposes.

Extract from "ENGINEERING," September 6th, 1872:—

"The accompanying engraving illustrates a large specimen of the 'Special' Steam Pump, which was brought before the public about four years since by Messrs. Tangye Brothers and Holman. The Pump is the invention of Mr. S. Cameron, of New York, and since its introduction Messrs. Tangye have turned out nearly 3000 from their works.

"These pumps are of various sizes, and at first only small ones were made, but as their usefulness became developed the manufacturers designed pumping engines on the same principle for use in collieries. They were first applied to this purpose in the Newcastle collieries about three years since, and through the efforts of the late Mr. A. Stansfield Rake, under the direction of Messrs. Tangye, about 130 of these pumps had been introduced—principally in the collieries of the Durham and Newcastle districts, up to the end of 1870. They were adapted to perform the required duty—varying in almost every case—of forcing from 1000 to 10,000 gallons per hour from depths ranging from 100 to 500 ft. The success of this system of pumps led Mr. J. Bigland, the manager of Messrs. Pease's Bishop Auckland Collieries, to conclude that it was adapted for yet heavier work. The result of his investigations into its working led to the manufacture of the engine we have illustrated, for the Adelaide Collieries, belonging to Messrs. Pease, at Bishop Auckland.

"The construction of the Special Steam Pump is so well known

that we need now do no more than refer to the dimensions of the various parts. The steam cylinder is 26 in. diameter, and the pump—which is double acting—is 6½ in. diameter, with a 6-ft. stroke. The slide valve is steam-moved, and its alternate action is effected by means of two steel reversing valves, operated by the piston in the interior of the cylinder at either end. Hence there is no external mechanism except the piston rod, a few inches only of which is seen reciprocating between the stuffing boxes of the steam and pump cylinders. In the contract it was stipulated that the engine should raise 120 gallons per minute 1040 ft. high in a single lift, and this is more than accomplished, with apparently as much ease as if its load was delivered at only 100 ft. high.

"The engine-room at the Adelaide Collieries is situated at a depth of 1040 ft. below the surface, and is an arched chamber, about 100 ft. long by 20 ft. wide, and 10 ft. high at centre. At the far end of this chamber is a double-flued boiler, 27 ft. long and 7 ft. in diameter. Placed between the boiler and the shaft is the pumping engine we have been describing. It was started on June 6, 1871, and Mr. Bigland reported that, having measured its duty, he found the average of seven trials to be 137 gallons per minute, thus giving a higher duty than was stipulated for in the contract.

"A still larger Special Steam Pump than the one already described

has since been made by Messrs. Tangye for Messrs. Stannier's collieries, Silverdale, Staffordshire. The steam cylinder of this engine is 32 in. in diameter, and the water cylinder 10½ in.; the stroke is 6 ft., and the engine has to raise 22,500 gallons per hour 540 ft. high. Two out of eight engines for some extensive coal mines in Germany are also in a forward state; each of these engines is to be capable of raising 150 gallons per minute, or 9000 gallons per hour, 750 ft. high. This system of underground pumping engine undoubtedly carries with it the recommendations of simplicity and great power, with a small number of mechanical parts. Its first cost is also very moderate, as compared with the method of raising water from great depths by a series of 40 or 50 ft. lifts. Its practical value was attested in 1867 by the award of a silver medal by the Royal Falmouth Polytechnic Society, which is composed chiefly of mining engineers. In fact, these engines appear to solve a very important commercial question in mining operations—viz., the most economical and effective means of deep mine drainage. Their success has been established in the coal mines of Durham and Newcastle, and there is no reason why their adoption should not follow, as occasion requires, in the copper and tin mines of Cornwall, some of which are of great depth; and especially for foreign mines, where transport convenience and economy are of paramount consideration."

The "Special" Steam Pumping Engines are in use at the following among many other Collieries:—

Adelaide Colliery, Bishop Auckland.....	3 Pumps.	North Bitchburn Colliery, Darlington.....	2 Pumps.	Stott, James and Company, Burslem	1 Pump.
Acomb Colliery, Hexham	1 "	Newton Cap Colliery, Darlington	1 "	Straker and Love, Brancepeth Colliery	1 "
Blackfell Colliery, Gateshead.....	1 "	Normanby Mines	1 "	Seaton Delaval Coal Colliery, near Newcastle	1 "
Black Boy Colliery, Gateshead	1 "	Oakenshaw Colliery	1 "	Thornley Colliery, Ferryhill	2 "
Castle Eden Colliery.....	2 "	Pease's West Colliery	2 "	Thompson, John, Gateshead	2 "
Carr, W. C., Newcastle.....	4 "	Pease, J. and J. W., near Crook	5 "	Trimdon Grange Colliery	1 "
Etherley Colliery	1 "	Pease, J. and J., Brandon Colliery	1 "	Tudhoe Colliery.....	4 "
Gidlow, T., Wigan	3 "	Pegswood Colliery, near Morpeth.....	2 "	Vobster and Mells Colliery.....	2 "
Haswell, Shotton and Easington Coal Company	3 "	Pelton Fell Colliery	1 "	Widdrington Colliery, Morpeth.....	5 "
Lochgelly Iron and Coal Company	2 "	Railey Fell Colliery, Darlington	1 "	Whitworth and Spennymoor Colliery	5 "
Lochore and Capeldrae Cannel Coal Company	6 "	Right Hon. Earl Durham, Fence Houses.....	1 "	Westerton Colliery, Bishop Auckland.....	1 "
Leather, J. T., near Leeds	2 "	Skelton Mines	1 "	Wardley Colliery, Gateshead	1 "
Lumley Colliery, Fence Houses.....	1 "	South Benwell Colliery	5 "	Westminster Brymbo Coal Company	2 "
Monkwearmouth Colliery, Sunderland	1 "	St. Helens (Tindale) Colliery.....	1 "	Weardale Coal and Iron Company	5 "

PARTICULARS OF THE "SPECIAL" STEAM PUMPING ENGINES SUITABLE FOR HIGH LIFTS IN MINES.

Diameter of Steam Cylinder	6	8	10	8	12	16	10	14	18	21	14	18	21	26	16	21	24
Diameter of Water Cylinder	3	3	3	4	4	4	5	5	5	5	6	6	6	6	7	7	7
Length of Stroke	24	24	36	24	36	48	24	36	36	48	36	36	48	72	36	48	48
Strokes per minute	30	30	20	30	20	15	30	20	20	15	20	20	15	10	20	15	15
Gallons per hour	2,200	2,200	2,200	3,500	3,500	3,500	6,100	6,100	6,100	6,100	8,500	8,500	8,500	8,500	11,900	11,900	11,900
Height in feet to which water can be raised with 40 lbs. pressure per square inch of steam at pump.....	240	425	665	240	540	960	240	470	775	1,058	330	540	710	1,140	312	540	700
Diameter of Suction and Delivery	2	2	2	3	3	3	3½	3½	3½	3½	4	4	4	4	5	5	5
Diameter of Steam Inlet	3	1½	1½	1½	2½	2½	1½	2½	3	3½	2½	3	3½	4	2½	3½	4
Diameter of Exhaust	1	1½	1½	1½	2½	3	1½	2½	3½	4	2½	3½	4	5	3	4	5

PARTICULARS, &c.—Continued.

Diameter of Steam Cylinder	30	18	24	30	32	18	24	30	36	21	30	36	42	26	36	44	50
Diameter of Water Cylinder	7	8	8	8	8	9	9	9	9	10	10	10	10	12	12	12	12
Diameter of Stroke	72	36	48	72	72	36	48	48	72	48	72	72	72	48	72	72	72
Strokes per minute	10	20	15	10	10	20	15	15	10	15	10	10	10	15	10	10	10
Gallons per hour	11,900	15,660	15,660	15,660	15,660	19,800	19,800	19,800	19,800	24,400	24,400	24,400	24,400	35,240	35,240	35,240	35,240
Height in feet to which water can be raised with 40 lbs. pressure per square inch of steam at pump.....	1,100	300	540	840	960	240	427	665	960	264	540	780	1,062	282	540	800	1,040
Diameter of Suction and Delivery	5	6	6	6	6	7	7	7	7	8	8	8	8	10	10	10	10
Diameter of Steam Inlet	5	3	4	5	5½	3	4	5	6	3½	5	6	7	4	6	8	8
Diameter of Exhaust	6	3½	5	6	6½	3½	5	6	7	4	6	7	8	5	7	9	10

PRICES OF THE ABOVE ON APPLICATION.

Any combination can be made between the Steam and Water Cylinders, to suit Height of Lift and Pressure of Steam.

TANGYE BROTHERS & HOLMAN, 10, Laurence Pountney Lane, London, E.C.